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FIRST LOOKS

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COMMUNICATIONS

38.4 Kbits/Sec on Your Phone Line? PC LAN Labs Tests 7 High-Speed Modems

CONNECTIVITY

Battle of the Network Giants: LAN Manager 2.0 vs. NetWare 386 3.1

FREE UTILITY

Fine-tune Your VGA: PRISM Paints Your Screen with 262,144 Shades of Color

DECEMBER 11, 1990 THE INDEPENDENT GUIDE TO PERSONAL COMPUTING VOLUME 9 NUMBER 21

Word Processors
Should You Switch?

PC Labs tests 8 of today's top competitors.

- Graphical packages storm the market.
- Word and WordPerfect guard their turf.
- Old corporate standards try to hang on.

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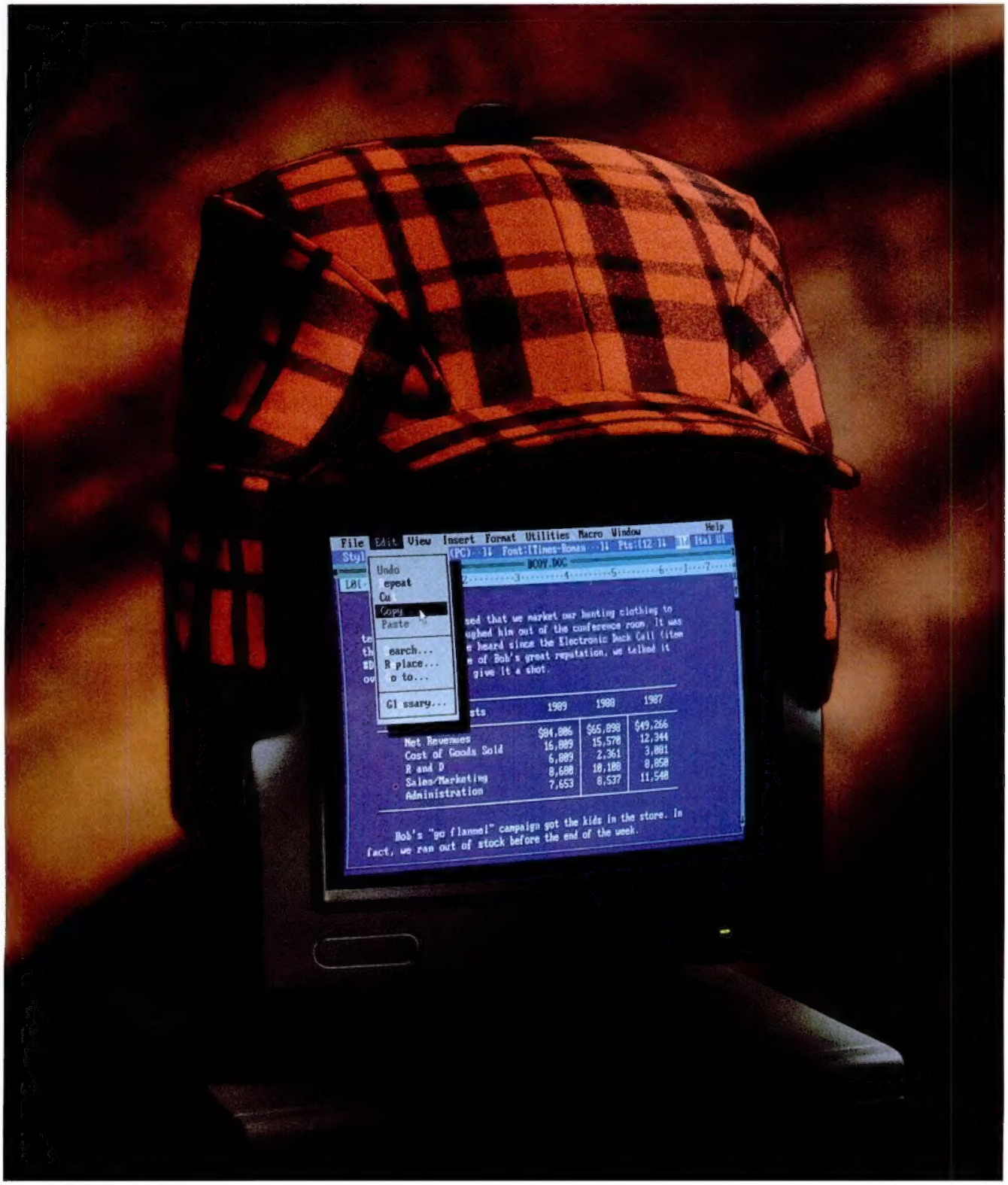
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1989 1988 1987
Net Revenues $84,886 $65,898 $49,266
Cost of Goods Sold 16,889 15,578 12,344
R and D 6,889 2,361 3,881
Sales/Marketing 8,688 10,188 8,850
Administration 7,653 8,537 11,548
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ason is over.

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CIRCLE 726 ON READER SERVICE CARD

Inside

This issue's cover story focuses on the eight major corporate-level word processors that together constitute almost 90 percent of the word processing market.

No other topic elicits such strong reactions from readers. We know how attached you are to your word processor; we know you don't want to switch to a new one; and we don't necessarily recommend that you do. But if you take a look at the innovative features some of these packages include in their latest versions, you may be moved to experiment.

Along with the eight word processor evaluations, we have included a somewhat subjective but nevertheless instructive evaluation of three of the most popular grammar-checking packages. In order to test these writing assistants in a real-world scenario, assistant editor Rink Murray wrote a truly terrible business memo riddled with all kinds of errors, some subtle, some glaring. Then he pitted the grammar checkers against the best competition he could find: *PC Magazine*'s very own grammar checker, copy chief and copy-editing guru Glen Becker. There's no need for suspense; the human being did the best job of cleaning up the messy memo. The contest wasn't even close.

Becker oversees five copy editors, all of whom work under the direction of copy edit manager Karen Carter. Carter and her staff of sticklers are our guardians of style, the ones who decide that *PC Magazine* will call a megabyte an MB—not an Mb, not a meg and not an Mbyte—and then enforce that rule with an unwavering iron hand.

Along with the editorial-production staff, the copy editors also serve as error-catching consistency cops, taking the time to make sure that when a review cites the price of a software package as $249, the features table, the fact file, and the Editor's Choice box all agree. Given that the average issue of *PC Magazine* can easily contain 120 product evaluations, that's no small accomplishment.

***PC Magazine*'s copy edit team: The people who guarantee every issue's consistency and readability.**

And as some of the first people to see the articles that will evolve into an issue of *PC Magazine*, the copy editors also play the vital role of first readers, bringing unclear or technobabble-heavy paragraphs back to other editors and asking, quite simply, "What's this supposed to mean?"

So as we look back at 1990 and tally up another 4,000 carefully copy-edited pages, we salute the eagle-eyed team that scrutinizes every line. Twice. Their names are Glen Becker, Karen Best, Stephanie Izarek, Michael Muchmore, Ann Ovodow, and Oliver Rist, and I'm sure I've spelled them correctly.

—Donald P. Willmott ■

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CIRCLE 259 ON READER SERVICE CARD

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†Patent Pending

PC MAGAZINE

December 11, 1990

Volume 9 Number 21

UP FRONT

4 INSIDE

15 LETTERS

27 ADVISOR
Gus Venditto/ Where to find BIOS upgrades for an aging IBM; planning an OS/2 strategy; sharing spreadsheets with a Mac.

33 FIRST LOOKS
■ **TravelMate 3000:** TI's 6-pounder packs 386SX power with a floppy.
■ **GRiDCase 1550sx:** Isopoint device readies laptops for *Windows*.
■ **SatisFAXtion:** Intel's fax/modem combo.
■ ***Adobe Type Manager*** provides Adobe Type 1 fonts for *Windows* 3.0 screens and printers.
■ ***InfoAlliance*** integrates corporate data.
■ ***Hijaak 2.0*** extends graphics conversion.

55 NEW AND IMPROVED
Rink Murray

65 READ ONLY
Matthew J. Ross

67 PIPELINE
Gus Venditto

COLUMNISTS

75 BILL MACHRONE
In The Driver Seat

81 JOHN C. DVORAK
Looking Back at A Slump

83 INSIDE TRACK

87 JIM SEYMOUR
Corporate Strategic Alliances II

95 WILLIAM F. ZACHMANN
Upsizing: The Other Half of the PC Equation

COVER STORY

107 SOFTWARE
Word Processors: The Best and the Brightest
Edward Mendelson/ PC Labs tests the latest versions of top-selling word processors along with previous Editor's Choices to help you determine if you're still using the right package after all these years.

110 Ami Professional
132 DisplayWrite
137 Microsoft Word
144 Microsoft Word for Windows
158 MultiMate
163 Professional Write
182 WordPerfect
188 WordStar

108 Editor's Choice
109 Suitability to Task
125 Low-Cost Options for Easy Word Processing
152 Summary of Features
167 It's Not What You Say But How You Say It
176 Performance Tests

FEATURES

195 CONNECTIVITY
LAN Manager 2.0 vs. NetWare 3.1: Networking in the 90s
M. Keith Thompson/ Novell's *NetWare* 3.1, the original network king, faces a formidable challenge in Microsoft's revamped *LAN Manager* 2.0.

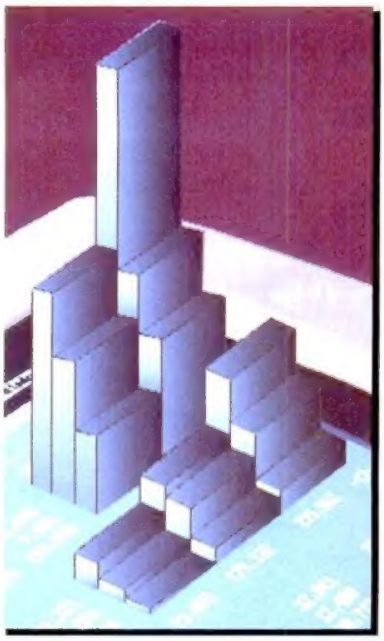
213 LAN Manager 2.0
228 NetWare 3.1

199 The Emerging Importance of Banyan's *VINES*
200 Editor's Choice
204 Named Pipes and Client/Server Computing
214 The LAN Manager Mixture
217 Summary of Features
220 3Com: Leading the Way in Interoperability
222 Testing the Hottest and the Fastest
224 Performance Tests

249 GRAPHICS
Who Needs a Graphics Package, Anyway?
Craig Stinson/ Your spreadsheet may have all the charting power you need. Our survey of the graphics capabilities of six leading spreadsheets shows just how far you can go with them.

256 Lotus 1-2-3, Release 2.2
258 Lotus 1-2-3, Release 3.1
261 Lotus 1-2-3/G
275 Microsoft Excel
288 Quattro Pro
290 Wingz

251 Editor's Choice
253 Suitability to Task
260 Supplementing *1-2-3*
273 Summary of Features
294 Charting in Bulk



FEATURES

307 COMMUNICATIONS
9,600-bps Modems: Breaking the Speed Barrier
Mike Byrd/ PC Labs tests seven of the fastest modems on the market.

316 ATI 9600etc/e
317 Hayes V-Series Ultra Smartmodem 9600 (Ultra 96)
328 Microcom QX/4232hs
333 MultiModemV32 MT932EAB
335 Telebit T2500
336 FasTalk V.32/V42b
341 Courier HST Dual Standard

309 Editor's Choice
312 Modem Alphanumeric Jungle
316 Data Compression: Is It All It Claims?
320 Summary of Features
324 Performance Tests

351 COMMUNICATIONS
Fax Line Managers: The Electronic Call Director
Frank J. Derfler, Jr. and R. Dennis Boatner/ PC LAN Labs tests 15 products that maintain your small business's professional image while letting you share a voice phone, modem, fax machine, and other devices on a single phone line.

354 ACCO 1-Line
359 FAXSaver Voice/FAX Switch
360 FAX LineShare
364 ASAP TF 555
364 AutoFax Switch
367 SmarterFax Switch
370 RemoteControl
370 The Switch
374 ExtraLine
384 SmartMax
384 Versa-Link
386 Automated Voice/Data Switch TB-150
391 Fax Line Manager
394 PathFinder
398 FaxSwitch II

352 Suitability to Task
354 Editor's Choice
380 Summary of Features
390 A Glossary of Line Management Terms

403 GRAPHICS
Low-Cost 3-D CAD: Modeling for the Masses
Bruce Haase/ To most people, 3-D CAD means a complex, powerful program at a high price. But this crop of three CAD packages is inexpensive enough for anyone's desk.

406 DesignCAD 3-D
408 Drafix 3-D Modeler
428 Generic 3D Drafting

406 Editor's Choice
414 2-D, 3-D, What's the Difference?
419 Features Table
435 Performance Tests

AFTER WORDS

605 AFTER HOURS
- *Jack Nicklaus's Unlimited Golf and Course Design* takes PC golf to a whole new level of realism.
- Two electronic jigsaw puzzles challenge you to put all the pieces together.
- Accolade's *Ishido* stimulates your imagination as it challenges your intellect.

610 ABORT, RETRY, FAIL?
Bill Howard

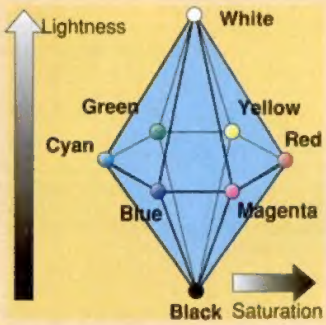
553 Reader Service Card
555 Direct Marketing Connection
572 Marketplace
601 Index to Advertisers
602 Advertisers' Product Index

PRODUCTIVITY

439 LAB NOTES
Winn L. Rosch/ An Introduction to Rewritable Optical Disk Technology

463 UTILITIES
David Gerrold/ Free Your VGA from CGA Captivity with PRISM.EXE

483 ENVIRONMENTS
Charles Petzold/ An Introduction to Rendering Color on Video Displays



493 POWER PROGRAMMING
*Ray Duncan/*An Introduction to Building Applications With *ToolBook*

503 WINDOWS
William S. Hall/ If you're dissatisfied with the fonts *Windows* has selected for your video driver, you can easily change them; an alternative to the File Manager's Expand All menu option.

509 DATABASES
Trudy Neuhaus/ Explore the menuing, commenting, and command-language enhancements of *R:BASE* 3.0. You'll discover some good reasons to upgrade.

527 SPREADSHEETS
Craig Stinson/ Use *Microsoft Excel*'s customizing tools to build new menus, commands, and dialog boxes that allow you to switch easily between *1-2-3-* and *Excel*-file directories.

533 THE WORKING WORD
Craig L. Stark/ Two handy *Microsoft Word* subroutines simplify macro editing and saving; two other *Word* macros let you shell out to DOS and print the current page with a single keypress.

539 USER-TO-USER
Neil J. Rubenking/ Increase your color options with DEBUG scripts that let you switch VGA output to 64 shades of gray or create bright backgrounds in DOS.

547 TUTOR
Jeff Prosise/ Understand how Microsoft's XMS driver, HIMEM.SYS, lets you access memory above 640K.

551 CONNECTIVITY
Frank J. Derfler, Jr./ Overcoming the distance limitations on parallel cables; choosing a network; programming a PBX; introducing the Multiuser DOS Federation.

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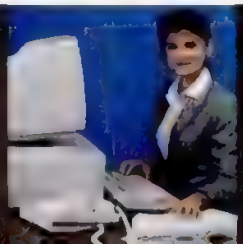

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HIGHLIGHTS

- 80386/DX Intel 25MHz Microprocessor
- 2Mb RAM (expands to 8Mb on system board)
- 125Mb Super-Fast IDE Hard Drive with 32K Cache
- 14" Austin High Clarity VGA Color Monitor
- Super-Charged VGA Video Adapter (supports up to 1Mb VRAM)
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- 80387 Math Coprocessor Socket
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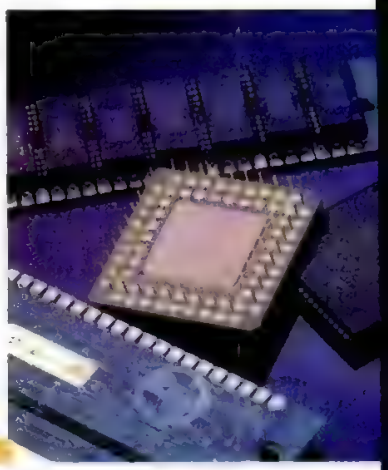

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HIGHLIGHTS

- 80386 Intel 33MHz Microprocessor
- 4Mb RAM (expands to 32Mb on board)
- 128K System Cache
- 125Mb Super-Fast IDE Hard Drive with 32K Cache
- 14" Austin High Clarity VGA Color Monitor
- Super-Charged VGA Video Adapter (supports up to 1Mb VRAM)
- Pre-Loaded with Microsoft Windows 3.0 and MS-DOS 4.01
- Microsoft Mouse
- New Small Footprint Chassis
- Complete System for only $3890!

AUSTIN 386/33 WINSTATION

STANDARD FEATURES

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- Dual Floppy/IDE Hard Drive Controller—1:1 Interleaving
- Intel 80387 or Weitek 3167 Math Coprocessor Socket
- 7 Expansion Slots (1 8-bit and 6 16-bit)
- 1 Parallel and 2 Serial Ports
- Enhanced 101 Keyboard with Tactile/Click Touch
- Real-Time Clock with Battery Backup
- Compatible with DOS, OS/2, and Unix

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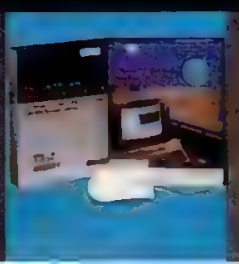

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HIGHLIGHTS

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- EISA Bus Architecture
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- 125Mb Super-Fast Hard Drive with 32K Cache
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- Super-Charged VGA Video Adapter (supports 1Mb VRAM)
- Landmark v1.14 Rating-113.8MHz
- Complete System only $5990!

AUSTIN 486/25 WINSTATION

STANDARD FEATURES

- 8 32-bit EISA/ISA Compatible Slots
- 6 Slots available for Bus Masters
- 4167 Weitek Math Coprocessor Support
- Shadow RAM Caching (BIOS/Video)
- Dual Floppy/IDE Hard Drive Controller—1:1 Interleaving
- Floppy Drive (1.44Mb or 1.2Mb)
- 1 Parallel and 2 Serial Ports
- Enhanced 101 Keyboard with Tactile/Click Touch
- Real-Time Clock with Battery Backup
- Microsoft Windows 3.0 and MS-DOS
- Microsoft Mouse
- Fully Novell, DOS, OS/2, and Unix Compatible
- EMS LIMM 4.0 Support

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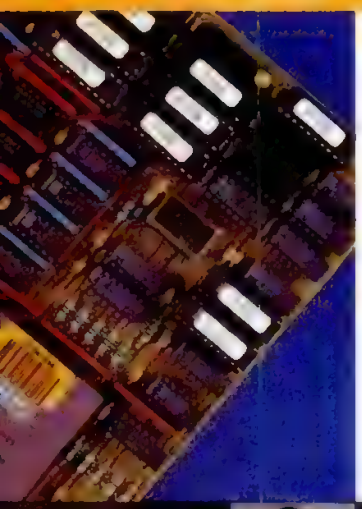

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AUSTIN 286/16

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HIGHLIGHTS

- 80386SX Intel 16MHz Microprocessor
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- 80387/SX Math Coprocessor Socket
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- 80387/SX Math Coprocessor Socket
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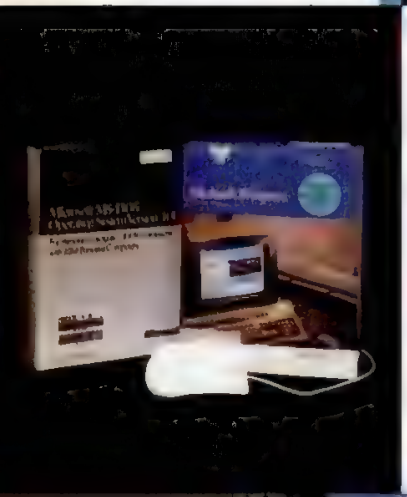

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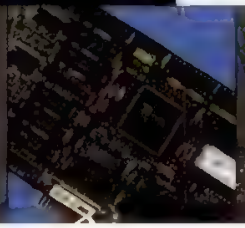

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Every Austin Desktop comes with 1 year of on-site service from GE. That means we'll have someone to your computer site usually within 24 hours! We even offer extended GE contracts for up to five years.

Get the best of Windows and OS/2 without learning all this.

Sure, you want to get your PC flying. With features like multiple open applications and background printing. Maybe even the ability to maintain your host connection while you work on something else.

But for that you need Windows or OS/2. Which means you also need to learn enough to get a pilot's license. And spend enough on hardware and software for a down payment on a jet.

PC MAGAZINE EDITORS' CHOICE October 30, 1990 Software Carousel Version 4.0

But with new Software Carousel, you can get the biggest benefits of Windows and OS/2 by doing almost nothing.

It's #1 in task switching software.

Software Carousel got to be a best-seller because it works. Simply and reliably. Day in and day out.

And because it gives you the single most practical and powerful function of OS/2 and Windows—the ability to quickly switch from one application to another.

Simply load your programs as usual in individual Software Carousel work areas (it handles up to 12). Then switch Software Carousel. Even RAM resident utilities, graphics programs and network software. And Software Carousel works on all types of PCs. So you can have the kind of multi-application capability you want, without buying anything new.

Now with Print'N'Run.

Thanks to Print'N'Run, new Software Carousel is also an advanced print handler. One that quickly takes over your printing jobs by accepting all the output bound for the printer, then sending it to the printer as fast as it can take it.

While your printer keeps running, you can keep working in the same application. Or switch to another Software Carousel work area running a different application.

No more wasted time waiting for your printer. No more lost productivity.

OLÉ. A network idea whose time has come.

OLÉ is the optional Open Link Extender* any host or service over a network—whether it's a mainframe, a mini, etc.—then "switch away" to work on another application, and not lose your connection.

OLÉ even makes sure that incoming data is received, even though your PC may be occupied with another application.†

And OLÉ works with all kinds of connection software. Including IBM, Attachmate, and others. Without changes to your hardware or software.

Even the experts agree.

Garry Ray, writing for PC Week, said, "Of these alternative operating environments (OS/2, DesqView and Software Carousel), Carousel may be the best choice of the day."

Barry Simon of PC Magazine concurred with, "...I find it difficult to imagine using my computer without Carousel. This package has become an essential tool and one that I strongly recommend."

So if you really want the major benefits of

Letters

A SPOTLIGHT ON WINDOWS

I read with great interest your September 11, 1990, article, "Windows 3.0 Under the Spotlight," noting your use of the phrase "breaks the 640K barrier."

I am waiting for someone to tell it like it is: *Windows* 3.0 does *not* break the 640K barrier. In fact, in virtual mode, the user is confronted with *multiple* 640K barriers. This is twice hinted at in your article: 3.0 is not a substitute for *DESQview*, and RAM crunch "may" occur with a network.

It is a simplistic but not practical solution to suggest switching to *Windows*-based applications, given the time invested in learning our programs and the thousands of files that must be converted. Indeed, I wonder whether the limitations of 3.0 are a Microsoft marketing device to push sales of all those Microsoft-licensed *Windows*-based applications.

The result is that my *Windows* 3.0 program is on the shelf, gathering obsolescence, and until the 640K barrier faced by millions of us DOS users is truly eliminated, that is where it will stay.

Clifford Schwartz
New York, New York

WE NEED MORE HUMOR

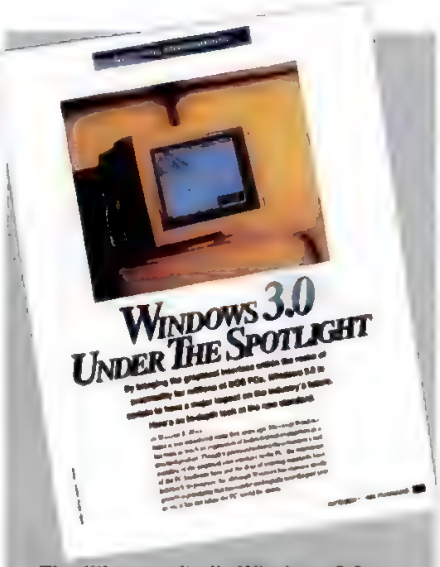
Kudos to John C. Dvorak's September 11, 1990, editorial. In a working environment where every pushed key must be right to get the desired results, real-life humorous stories can make it bearable. I suggest that aside from the "Abort, Retry, Fail?" page, this type of humor should be a regular feature of your magazine.

Regi Soolook
Fairbanks, Alaska

THE COST OF MULTIMEDIA

William F. Zachmann, in "The Cost of Multimedia" (September 11, 1990), is 100 percent correct when he states that a 386 PC or Macintosh multimedia machine is too expensive. But he failed to look at the alternative: Amiga.

The Amiga from Commodore is the recognized leader in this new field. An Amiga 3000 offers a sophisticated GUI, multitasking, four-channel stereo digital sound, NTSC video compatibility, an icon-oriented authoring system (Amigavision), a 32-bit bus, one *gigabyte* address space, synthesized speech, and an IBM PC AT-compatibility option for under $5,000.



The title says it all: *Windows* 3.0 has *certainly* been under the spotlight, and will continue to be.

Multimedia *will* be more than a buzzword in the 1990s. The Amiga will make it possible.

John Byrne
Baltimore, Maryland

William F. Zachmann is obviously poorly informed about his subject ("The Cost of Multimedia"). The apparent reason is that he is focused only on the PC and similar computers. The bottom line is that multimedia applications are currently being utilized in the business world, and for much lower costs than Mr. Zachmann implies.

Utilizing my Amiga computer, I can run seven separate inputs from such diverse sources as CD-ROM and video cameras, controlling them with the software in the computer and outputting to a video recording unit. I can also do animation at real-time rates, create video special effects, and generate professional-quality video titling.

At the same time, the unit will multitask such diverse operations as a database, word processing, and spreadsheets without software such as *Windows*. While my system runs at only 16 MHz, I am looking at an upgrade to 50 MHz. On-board memory is 3MB, expandable to 9MB. The total cost is less than $5,000, not the $10,000-plus referred to by Mr. Zachmann. And as you can see, this computer will run rings around the fastest PC currently marketed.

Roger D. Strahan
Denton, Texas

I think Mr. Zachmann has missed the point in his assessment of multimedia. Multimedia *isn't* pictures, animations, video, sound, and text. It's just a term attributed to the idea of communicating information in the format in which that information is most easily or efficiently expressed.

Monthly sales figures are most easily expressed in numbers, while statistical data is more effective in graph form. And I'll bet many people would prefer to send electronic mail by speaking their message rather than typing it.

The role of the computer in multimedia is to tie the various types of media together. Indeed, a multimedia electronic mail system that supports graphics, image, text, and voice could finally make "office automation" a practical reality.

While the Commodore Amiga's sound and graphics capabilities aren't state-of-the-art by any measure, the Amiga has been successful with multimedia applications because these features are included as standard equipment and, more importantly, are accessed through standard programming interfaces, making it cost-effective for developers to create software exploiting those capabilities.

Kevin M. Rahe
Montague, Michigan

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Letters

Unfortunately, the Amiga is not IBM-compatible and therefore not subject to our review.—*Ed.*

CRANKING OUT THE STATS

I've been a subscriber to your magazine for almost a year now and I've found the feature articles and tips from readers to be quite helpful.

Coming home from the office, I find it nice to pick up my copy of *PC Magazine* and read your reviews and benchmark tests of the latest and greatest hardware. There is one thing that you could do, however, that would make my life just a little easier.

Since I'm a statistics freak, I like to calculate the mean and standard deviations from your benchmark results, to test for significant differences. Could you spare us overworked, stressed-out folks a little trouble and publish these two statistics (mean and standard deviation) so we don't have to crank it all out on our own?

If you get a chance, could you also ask IBM if its next hardware release will be a 4.77-MHz dual floppy called the PS/0?

Matthew S. Jarvix
Albany, Oregon

Publishing those two statistics—the mean and standard deviation—is definitely something we're looking into for the future. Unfortunately, it's not possible yet with the high volume of hardware we see in the Labs.—*Ed.*

WHOSE FAULT IS IT?

In his plea for more computers in the classroom to make Johnny computer-literate (September 25, 1990), Bill Machrone fails to apportion blame to the teachers' unions.

If software programs were used to self-teach subjects such as reading and geography, we would need fewer teachers. The savings in payroll could be used to buy the necessary computers without playing the game of saving cash register tapes or soup labels.

George C. Gross
Brimfield, Massachusetts

MAKING THE CHANGE TO OS/2

I switched over from DOS about 12 months ago, originally to OS/2 1.1, then 1.2, and now to 1.21. Your articles greatly assisted me in resolving some of the technical problems I encountered.

Making the change to OS/2 has naturally involved a few difficulties, which is to be expected from something new. But the move has been well worth it. Multitasking has greatly improved my productivity. And my system never crashes like it used to do when running some of my more-complex DOS-based applications.

> Toll-free support is a Good Thing; don't even *think* about changing it!

Keep up the good work with your fine coverage from Charles Petzold, Ray Duncan, and others.

Robert Mayer
San Francisco, California

WHY WINDOWS?

Mr. Blume's letter ("Why Windows?" August 1990) prompts me to write this, my first letter to a magazine, in support of your *Windows* column. After years of working with the command line, I tried *Windows/386* with my home computer. While not impressed with *Windows/386,* I am definitely impressed with *Windows* 3.0.

My reason for trying *Windows* was multitasking with the programs I use at work, *SuperCalc5* and *WordPerfect* 5.1. After several attempts, I am unable to get *WordPerfect* to run without locking up. Thanks to your column, I learn something new every issue. Your August issue, for example, indicates that *WordPerfect* will run under *Windows,* giving me motivation to try again before switching to *Ami Professional.*

Thanks again for your column.

Steve Snow
Albany, New York

I had to write regarding Mr. Blume's letter in your August issue. I agree with Mr. Blume: *Windows* might be coming with Version 3.0, but as far as the real world is concerned, it is not here yet.

It is interesting to note that you never mentioned the GUI by GeoWorks. Like Mr. Blume, I believe that the current *Windows*

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PC MAGAZINE
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SEPT. 11, 1990
TRI-STAR
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PC MAGAZINE - SEPTEMBER 11, 1990

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PC MAGAZINE - July, 1990

"Support Policies - Excellent."
INFOWORLD - MAY 7, 1990

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PC MAGAZINE

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Of course, a computer with a real 386 Intel main system board should get only the best components too —like Conner hard drives with capacities up to 200MB, the best TEAC floppies, Orchid VGA adapter cards instead of cheap imports and the best NEC and Matsushita monitors.

Most importantly, these are all FCC class B approved units. That's the highest and most difficult rating to obtain. You should know that many other vendors' systems are not class B rated so with theirs you might have a problem later.

One thing more. When you buy a DataWorld computer you get a better price, too.

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386/25e SUPER VGA/4MB RAM/100MB HD $2,789
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386 intel

The 386/25i and 386/33i are designed around a genuine Intel main system board. These systems incorporate the finest components including 64K cache memory.

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486

Designed around our advanced 486 main system board that uses the new Intel 486 microprocessor with a built-in 8K cache. These systems are standard with 4MB memory (expandable to 16MB); Weitek 4167 coprocessor support; 16-bit 512K VGA adapter (expandable to 1MB); Matsushita super VGA (14" 1024X768) and optional NEC monitors.

These 386 and 486 systems include a Conner 100MB IDE hard drive as standard equipment. You can have virtually any drive you want from 40MB up to 600MB in IDE or ESDI formats from the industry's top manufacturers like Conner and Micropolis.

And all desktop units are equipped standard with both 1.2MB and 1.44MB floppy drives; 101-key enhanced keyboard; 2 serial/1 parallel ports; heavy duty steel case; 5 half-height drive bays; 200 watt power supply; LIM EMS 4.0 drivers; FCC class B certification and FREE 1 year TRW on-site service.

We can also add an optional 120MB or 500MB tape drive, if you like.

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386/25MHz PORTACOMP III $2,955
SUPER VGA/4MB RAM/100MB HD

The PORTACOMP uses a VGA gas plasma (640 x 480 with 16 gray scales) display that delivers sharp clear screens even under severe lighting conditions. It also supports an external color VGA monitor simultaneously.

Its full function keyboard and two full-sized expansion slots mean this mobile system can be upgraded for just about any application.

These systems are standard with 1MB memory (expandable to 8MB); 40MB Conner IDE hard drive (optional up to 200MB); 1.44MB 3.5" floppy drives (or optional 1.2MB floppy) and 101-key enhanced keyboard with separate numeric and cursor keys; 2 serial/1 parallel ports; 2 full-length 16-bit ISA expansion slots; carrying case; and 150 watt power supply (110/220V auto-switching).

PC MAGAZINE
Endurance Tests Data 386/25A—Jan 16, 1990

PC MAGAZINE EDITORS' CHOICE
Data 386/25 May 30, 1989

PC MAGAZINE EDITORS' CHOICE
Data 386/20 May 30, 1989

PC MAGAZINE EDITORS' CHOICE
Data 386/16 Feb 28, 1989

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Portacomp II Oct 11, 1988

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Recently, the editors at InfoWorld magazine compared our new portable laptop LP-320 (setup value $3,025) to Compaq's Portable 386 (setup value $8,997) and Toshiba's T5200 (setup value $8,497). Here's some of what InfoWorld said,

1) **Speed: "DataWorld's disk-intensive total was the best."**
2) **Screen: "VGA-compatible screen that has a dark-and-bold font that is unusually sharp."**
3) **Battery: "No other system in this comparison (Compaq nor Toshiba) supports a battery."**
4) **Support: "Helpful technicians who accurately answered our questions."**
5) **Value: "The DataWorld system is a great value. This is a solid buy."**

INFO WORLD "Bustin' Out" Sept 3, 1990

LP/320 SUPER VGA/1MB RAM/43MB HD $2,650
NOT ALL THAT COSTS LESS IS LESS

When we began to design the LP-320 we asked our customers what they thought was a good deal and we'd make it.

They thought they had us, smiled and said, "Give us a laptop with better performance but at half the price of the Compaq and Toshiba models."

We started with a genuine Intel 386 20MHz 32-bit processor, a sharp LCD VGA super-twist screen that offers high contrast 640 x 480 normal or reverse video display, 80387 coprocessor support, 1MB RAM that's expandable to 8MB, a Conner 43MB 25ms IDE built-in hard drive (you can choose an optional 100 or 200 megabyte drive!), a 3.5" 1.44MB floppy, 1 parallel, 2 serial ports, and 1 expansion slot, and we put it all in an attractive solid case strong enough to go on the road.

And, because we believe the concept of a laptop demands portability we added a built-in rechargeable battery, so you can take them anywhere and work comfortably. We also added a separate numeric keypad, an AC adapter and carrying bag as standard equipment. And you can add a few nice options like serial mouse, full desktop size VGA monitor, an internal modem, a 5.25" external floppy and even a 120MB tape back-up.

When we showed the first prototype model of the LP-320 everyone agreed that the LP-320 is no ordinary laptop. It's made for users who value advanced technology and top performance—and for users who appreciate extra special touches that other laptops don't have, such as number keys and a sleep mode that extends the battery life.

And since laptops have to conform to the same laws of government and nature as larger desktops, our LP-320 offers the security of FCC class B certification and FREE 1 year TRW on-site service as well.

Of course, with a laptop this good you'd expect it to be the most expensive.

It's not.

That's the best part. While the Compaq Portable 386 and Toshiba T5200 are priced over $8,000 each (and they don't have battery support or numeric keypad), we priced the LP-320 at an incredible $2,650, complete!

That's probably why some customers call us the company with the best technology, while others call us the company with the best prices. They're right.

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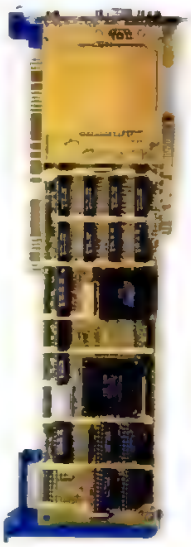

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That way, you can select the path that's right for your business, all the while enjoying the kind of reliability and IBM® compatibility that make DCA's IRMA products so highly successful.

Yet our appeal doesn't stop at flexibility. IRMAtrac offers better performance than IBM's token-ring due to bus-master technology. And we're compatible with the industry-leading network operating systems, including Novell® Netware® 286 and 386, DCA 10Net,® Microsoft® LAN Manager, 3+Open,™ IBM LAN Server Program, and IBM PCLAN Program. Plus, other microcomputer architecture versions, such as Macintosh, will be available in the future. Which is highly unlikely from IBM.

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For more information on IRMAtrac Token-Ring just call us at 1-800-241-IRMA, ext. 64A.*

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Letters

hype is only good PR from Microsoft for a poor technical achievement.

As for the *Windows* year—we heard something similar about OS/2—was it already four years ago?!!

René Dalle
Kanata, Ontario

PC MAGAZINE As a matter of fact, we have given GeoWorks some coverage recently: first, in our October 30, 1990, issue in Pipeline; then in "The Tyranny of Choice," Bill Machrone's column in the November 13, 1990, issue.—*Ed.*

FUNCTION BEFORE FORM?

Your 3-D bar charts look great. They have tremendous impact, and with that classy shading they really jazz your pages. Unfortunately, they are virtually impossible to interpret. Page 263 of your June 26 issue was a classic example. Look at it again and try to work out some comparative values, that is, between tasks for different utilities. It is hopeless. If you want to get your message across, stick to nice simple tables and bar charts. Rein in your designs—remember the maxim: function before form.

Paul Stapleton
Rome, Italy

THE WAR OF THE NUMBERS

While I frequently agree with Jim Seymour, I must take issue with his conviction that the industry must evolve to 900-number pay-per-call support (September 25, 1990). The prime example, as Seymour himself acknowledges, is *WordPerfect*. Although I might find a better program for a particular client, none carries the support provided by WordPerfect Corp., and therefore none gets my blessing.

I am convinced that support is a primary factor in WP's leadership. If nothing else, support provides two-way contact that forms the basis for constant improvement. I have seen at least three different releases of Version 5.1 to date. The motivation to upgrade the initial release is directly related to the support group's intimacy with the users.

I understand the argument that corporate users do not need the same level of support that others may, and therefore it is wrong to build support price into the front-end program cost.

Users could equally argue that they don't need to be convinced by advertising and should not pay that cost either. I argue that advertising, support, and product quality are the factors that build sales. A large sales volume provides superior financial resources to enable the smart developer to sustain superiority.

Let's not rock the boat by changing a formula that has proven successful. Toll-free support is a Good Thing; don't even *think* about changing it!

Herbert M. Honig
Englewood, New Jersey

TRACKING THE TRACKMAN

I enjoyed reading the article and review of the mice and trackballs in your August issue. However, I did discover one inaccuracy.

You stated in your "Editor's Choice" column that the Logitech trackball is equipped with a Drag/Lock button. That is not correct; the Logitech TrackMan is not equipped with such a button. I thought I was missing something, so I verified this with Logitech.

Let me add, though, that I do not find the lack of such a button on the Logitech TrackMan a drawback. The design of the device is so comfortable that rolling the ball with the thumb while depressing a button is not a problem.

David Harris
Springfield, Illinois

CORRECTIONS & AMPLIFICATIONS

In our March 13, 1990, issue, "Powerhouse Portables" cover story, Compaq's phone number should have read 713/370-0670.

HOW TO WRITE TO PC MAGAZINE

We welcome your comments, complaints, insights, and suggestions. Please send them to Letters, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload them to PC MagNet (see page 8 for access information). All letters become the property of *PC Magazine* and are subject to editing. Please address all mail to *PC Magazine* with the proper department printed on the envelope, so that we can quickly get your letter to the correct person(s). ■

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Digitizers
Genius
12x12 4btn, sw 239
12x12 pen, 4btn, sw 289
Kurta
12x12 pen, 4btn, sw 349
17x12 pen, 4btn, sw 559
Summagraphics
Summasketch II 12x12 305
Summa II 12x12 16button 329
Summa Pro 18x12 4button 519
LCL 36x48 pen 1925
Microgrid II 24x36 4btn 2495
Replacement Parts Call

Software
Carbon Copy Plus 5.2 92
Clarion Pro Developer Call
Copy II Opt Board Dlx 99
Corel Draw 299
Dbase III & IV Call
Design Cad 3.0 179
DesqView 2.2 67
DesqView 386 113
Drafix Ultra 184
Foxbase Plus 2.1 174
Foxgraph 169
FoxPro Call
Harvard Graphics 2.x 276
MS-Dos 3.3 & Basic 58
MS-Dos 4.01 & Basic 72
Norton Advanced 5.0 106
PageMaker 4.0 Call
PC Tools Deluxe 6.0 76
Peachtree Comp III 135
RightWriter 44
Spinwrite II 64
TimeLine 4.0 415
Turbo C ++ 2.0 84
Turbo C Pro ++ 2.0 Call
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Windows 3.0 Call
WordPerfect 5.1 5" 2[illegible]
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Mice
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Bus C9 72
Trackman Ser or Bus Low

Chips
Intel
8087-1 (10mhz) 147
8087-2 112
8087-3 89
80287-6 (80287) 119
80287-8 (AT-8mhz) 177
80287-10 19[illegible]
80287-XL 199
80387-16 305
80387-20 340
80387-25 435
80387-33 529
80387-SX16 269
CYRIX
83D87-20 295
83D87-25 370
83D87-33 449
IIT Math Chips
2c87-8 (8mhz) 165
2c87-10 (10mhz) 189
2c87-12 (12mhz) 199
2c87-20 (20mhz) Call
3c87 Call
MM 1x9 80ns 5[illegible]
PP 1x9 80ns 57

Drives/Tape
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HST Dual ext 829
HST v.32 ext 705

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60 / 85 281 / 348
150 267

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16bit VGA 512k 126
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VGA Plus 16 155
VGA 1024 256k 169
VGA 1024 512k 219
Video 7 VGA 1024i 512k 236
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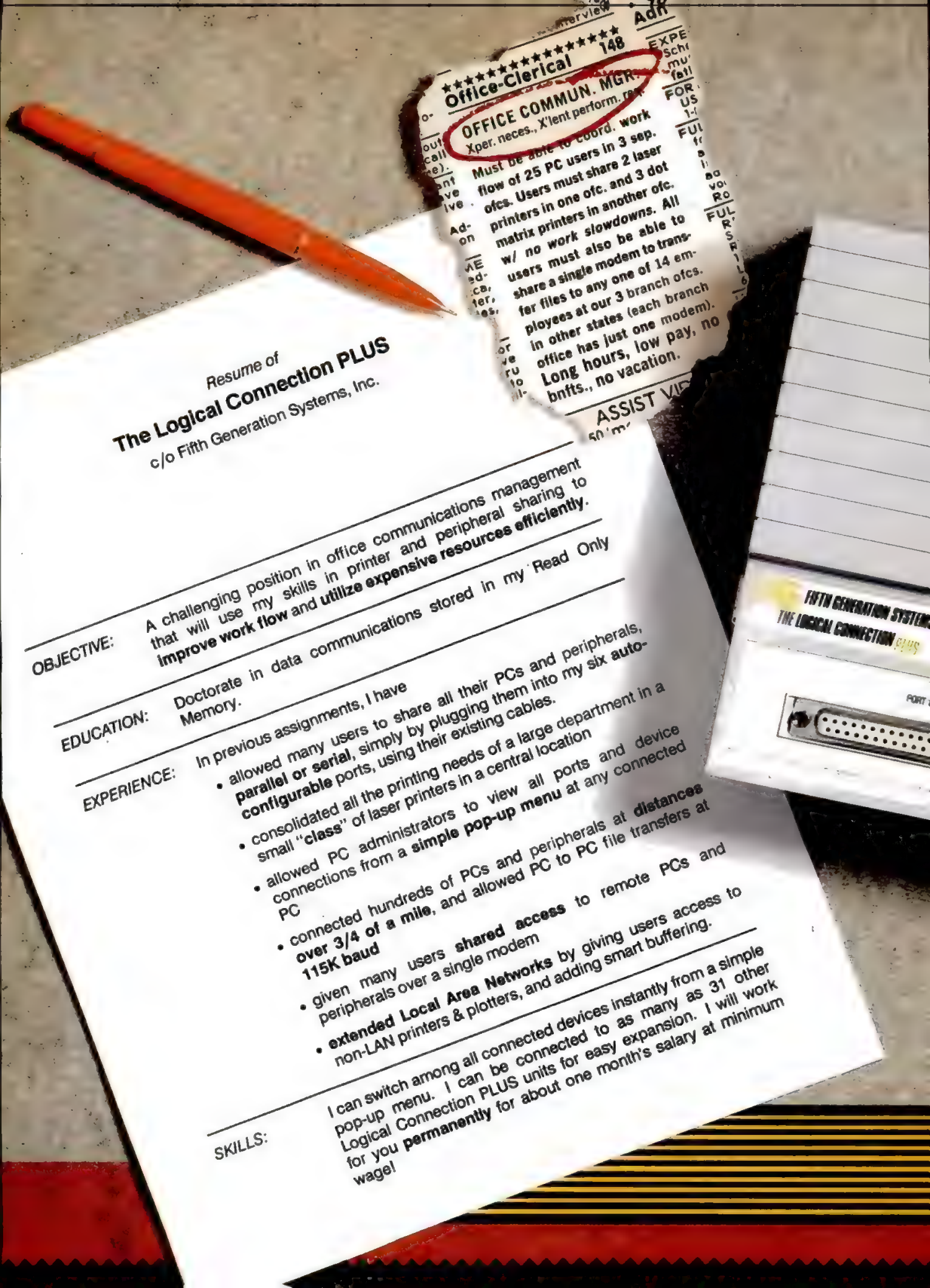
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148
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Xper. neces., X'lent perform.
Must be able to coord. work flow of 25 PC users in 3 sep. ofcs. Users must share 2 laser printers in one ofc. and 3 dot matrix printers in another ofc. w/ no work slowdowns. All users must also be able to share a single modem to transfer files to any one of 14 employees at our 3 branch ofcs. in other states (each branch office has just one modem). Long hours, low pay, no bnfts., no vacation.
ASSIST VI
Resume of
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c/o Fifth Generation Systems, Inc.
OBJECTIVE: A challenging position in office communications management that will use my skills in printer and peripheral sharing to improve work flow and utilize expensive resources efficiently.
EDUCATION: Doctorate in data communications stored in my Read Only Memory.
EXPERIENCE: In previous assignments, I have
• allowed many users to share all their PCs and peripherals, parallel or serial, simply by plugging them into my six auto-configurable ports, using their existing cables.
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12/26/89
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by
Gus Venditto

Advisor

NEW BIOS FOR AN OLD AT

For the amount of money I have invested over the years in my IBM AT, I could have bought a new clone screamer with enough left over for a 10-year subscription to *PC Magazine*. However, I've become attached to the old clunker.

My problem is that the BIOS does not recognize my 101-key enhanced keyboard so I do not have full use of function keys 10 and 12. Worse, I can only run my new 3.5-inch 1.4MB floppy drive as a 720-kilobyte drive. My local repair service says the problem can be solved by installing a new IBM BIOS, but IBM no longer will supply them.

Are there are other sources?
Michael McClure
Tucson, Arizona

You're probably lucky that IBM doesn't supply them. Komputerworks (Pittsburgh, Penn., 800/423-3400) has something a lot better.

For $95, you can get an Award 286 BIOS that, in addition to getting your keyboard and high-density drive working properly, will let you make any setup changes in ROM instead of through IBM's software procedure. And it will let you add new storage devices that IBM's BIOS didn't recognize. That means if you buy a new hard disk that isn't on the list of 47 recognized devices, the Award BIOS will let you enter the specifications for the device (cylinders, heads, etc.) in order to get it running properly.

Although there were two distinct AT BIOS versions (the 27-128 and 27-256), Komputerworks sells Version 3.12 of Award's BIOS which is a replacement for either one of the originals.

It's a simple job to pull out the original chips and slip in the new ones—just take your time when you make the switch.

CHOICES FOR OS/2 EXTENDED EDITION

We're planning to migrate from DOS to OS/2 and decided to go with IBM OS/2 Extended Edition to use the built-in communications features, like the LAN server and SQL access programs.

Most of our computers are IBM-compatible PCs, so will we have to start purchasing PS/2s to run OS/2?

I would like to know if we will be able to run the IBM version of OS/2 on the clones. If not, is Microsoft or any other company planning to release any communication, LAN and SQL programs that can be run together with Extended Edition on an IBM clone?

David C.
Rochester, New York

Microsoft has religiously avoided talk of introducing a generic version of OS/2 that will run on compatibles. There are simply too many integration issues: OS/2 is device-independent and that means the operating system must have drivers for every device in the system. It's clearly the responsibility of specific manufacturers of computers to know the configurations they've sold and to make certain all of the drivers are available for their own customers' systems.

So you'll want to get guarantees from the clone makers that they already have or soon will provide you with a version of OS/2 written for and tested on the configurations you're buying.

That said, you may find many of the systems you already own will run perfectly well with IBM's or another company's OS/2. But there's no way to know until you've tested it thoroughly yourself and you'll still run the risk of hitting a snag down the road—especially when you're exercising some of Extended Edition's 3270 communications functions.

Be especially cautious here, too, because IBM has said that there are features in Extended Edition that may require access to features in PS/2s. These nebulous features were never specified, but it would be unwise to invest lots of effort in developing Extended Edition applications on clones, simply because OS/2 EE boots up on them.

Finally, there are a wide range of options for the various elements in Extended Edition. Microsoft's offerings of *LAN Manager* and *SQL Server* come closest to the package IBM put together in Extended Edition, but neither Microsoft's nor anyone else's OS/2-based communications products should be expected to be completely compatible with Extended Edition. For example, Extended Edition is a requirement for running IBM's *OfficeVision* on PCs.

It's too early in the life of this expansive environment to say if *OfficeVision* will ever run on non-Extended Edition networks, but you'll be taking a risk if you expect to integrate compatibles into an Extended Edition environment down the road.

You have a simple choice: emulate Extended Edition functions with a mixture of LAN management, SQL access and communications programs, or buy

- NEW BIOS FOR AN OLD AT: Where to find the most important upgrade for an aging IBM.
- CHOICES FOR OS/2 EXTENDED EDITION: Planning a strategy for the next decade.
- SHARING 1-2-3 FILES WITH A MAC: Choices for moving spreadsheets around.
- EMULATING HP'S 11C CALCULATOR: Software that replaces an engineer's friend.

only PS/2s and Extended Edition.

If you want to get a second opinion on OS/2 EE, ask a salesman from Oracle (Belmont, Calif., 800/672-2531) to look at your needs and make a proposal.

SHARING 1-2-3 FILES WITH A MAC

Our company uses *Microsoft Excel* on Macs in branches throughout the world. Our clients, in general, use *Lotus 1-2-3*.

Could you advise me on the hardware and software I would need to work on my clients' Lotus files at home and then transfer the files to *Excel* on the office Macs?

Would I be able to transfer the files to the Mac directly without using a modem, using software?

Arun Rao
Forest Hills, New York

You have a lot of choices and it sounds like these spreadsheets bounce around quite a lot, so I'll just summarize the solutions that will make the most sense for you.

If you communicated with your clients via e-mail, no conversion software would be needed, since both versions of *Excel* can read and write their own .XLS worksheets and Lotus's .WK1. Of course, your e-mail system would need to have the capability of transferring binary files, not just ASCII.

If you're only concerned with using the Mac files at home, you could install a $149 Copy II PC Deluxe Option Card in your PC (Central Point Software, Beaverton, Oreg., 503/690-8090); it would enable your 3.5-inch floppy drive to read and write in Mac format. As long as you used the office Macs to save the files as .WK1 sheets, you'd be able to use either *Excel* or *1-2-3* on the PC at home.

Or, you could send the files home via modem or by a direct serial connection with *MacLinkPlus/PC* (DataViz, Trumbull, Conn., 203/268-0030; $199).

Probably the most sensible solution is for your office to either buy some of the latest Macs with an external 5.25-inch drive that reads DOS formats, or upgrade the existing Macs with Kennect's Drive 1200, a $395 add-on drive that uses an older Mac's existing floppy port (Kennect Technology, Los Gatos, Calif., 800/552-1232).

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First Looks

Hands-on Reviews of the Latest Products

Lightweight and Luxurious: Two New 386SX Laptops

TravelMate 3000: The Under 6-Pound 386SX

PREVIEW
by Matthew J. Ross

The new TravelMate 3000 gets a built-in floppy disk.

The most exciting news in the laptop arena is the emerging class of 386SX VGA notebooks. While Compaq's newly announced 7.5-pound LTE 386s/20 has received considerable attention, the Texas Instruments' TravelMate 3000 may be the most newsworthy. With a list price of $5,499 and a weight of 5.8 pounds, TravelMate 3000 is setting the standard for other 20-MHz SX notebooks to match.

The final product is now available, but TI delivered a near-production version of its SX to PC Labs. It weighs 5.8 pounds, including the optional $449 2,400-bps internal modem card that can send faxes and has MNP Level 5 data correction. Even when you add the 1.48 pounds of AC adapter brick and cables, the 7.3-pound total is less than the weight of Compaq's LTE 386s/20 notebook without these extras.

The TravelMate's 11- by 8.5-inch dimensions rival Compaq's, but the TI has a slight saving on height (1.8 versus 2.2 inches). TI comes with either a 20- or 40MB Conner hard drive (compared with Compaq's 30- or 60MB) and the $5,499 base model lists for $1,000 less than the LTE 386s/20.

The TravelMate 3000 packs a lot of value into its small dimensions. I/O devices include a serial and a parallel port, VGA connector, a PS/2 mouse connector, and an RJ-11 connector on the internal modem card. *LapLink*, *BatteryPro & Productivity Software*, and DOS 4.01 are preinstalled on the hard disk. The included *Laptop Manager* provides password protection. Other utilities allow you to change cursor size and intensity, remap colors on the 32 gray-scale-capable LCD and set display and disk shut-down times to conserve power.

The setup program's Auto CPU setting permits operation at 20 MHz when using AC power, 10 MHz under battery, and 8 MHz when the low battery LED indicator comes on. A similar setting for the LCD's backlighting is also present.

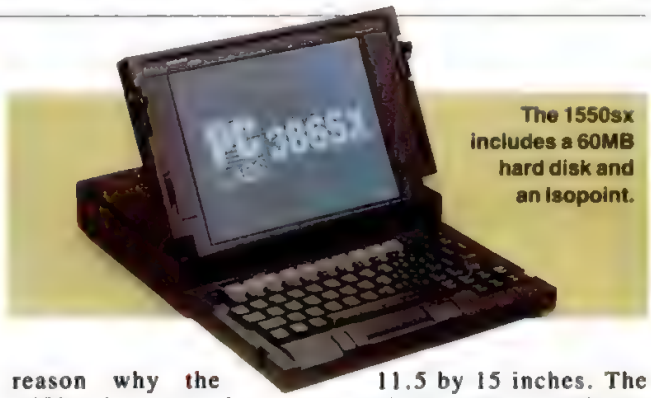
The TravelMate 3000 includes 2MB of RAM expandable to 6MB via two ($999) memory modules that are installed under the unit's keyboard, a 79-key unit with half-size function and cursor keys. The cursor keys are positioned in the preferred diamond layout; overall the keyboard is comfortable to use, with good key action and a slightly audible click.

One of the finer components

CONTINUES ON PAGE 34

GRiDCase 1550sx

HANDS ON
by Patrick Hunter



The 1550sx includes a 60MB hard disk and an Isopoint.

GRiD Systems has been building rugged portable computers since 1982. (In the mid '80s, NASA even used one on its space shuttle flights.) Today, GRiD is a wholly owned subsidiary of Tandy, a much more down-to-earth company, but the 20-MHz 386SX-based GRiDCase 1550sx maintains the legacy of power and ruggedness.

For example, the black magnesium case gives the unit a striking look, and is much sturdier than the plastic casing used on most laptop computers. It also costs more than plastic, one reason why the 1550sx is among the more expensive SX-based portable computers. (And since GRiD sells direct via its GRiD Systems Centers, you'll get no markdown on the price.)

The hefty 1550sx weighs 13.6 pounds with the battery installed, and measures 2.5 by 11.5 by 15 inches. The weight, height, and width are comparable to others, but the 1550sx is several inches deeper than most of its competition, a problem if you're working on the seatback tray of an airplane.

Another shortcoming is the battery life. It posted a time of

CONTINUES ON PAGE 34

PC MAGAZINE DECEMBER 11 REVIEW INDEX

***Plus* 2.0**
A *HyperCard* world for the PC.....36

***Quattro Pro* 2.0**
Goes for the presentation.....38

InfoAlliance
The data integrator....44

LightShip
Low-cost EIS under *Windows* 3.0.....46

CONTINUED FROM PAGE 33

TravelMate

is the video subsystem. The TravelMate uses a 7.75-by-5.75-inch VGA paper-white display manufactured by Sharp. The video circuitry will drive an external 1,024-by-768 Super VGA monitor at 16 colors. In addition to contrast and brightness controls, a toggle switch provides reverse video without your having to remember obscure key combinations.

Video performance is strong on the PC Lab's benchmark tests, and processor performance is also quite good. The TravelMate lags slightly behind the Compaq SLT 386sx/20, however, which achieves its performance edge from a processor RAM cache. TI attributes its processor and battery performance to its new low-power 83000 chip set.

Some fit and finish problems were evident, due to the fact that unit was preproduction. The internal battery pack was not production quality, so we did not test battery performance. Engineers at TI claim a 4-hour battery life, but reported that testing reported an average life of 3 hours and 20 minutes, similar to the times we found in our use of the notebook. A complete recharge takes 4 hours.

The notebook's video BIOS didn't address the LCD's full display area under character-based modes, but graphics programs used the entire screen. TI has made adjustments to its BIOS to remedy this problem.

TI's joint venture with Sharp produced the trendsetting Travel Mate 2000 and the Sharp PC-6220. Now TI assumes the lead in performance/pound/price measure of a notebook.

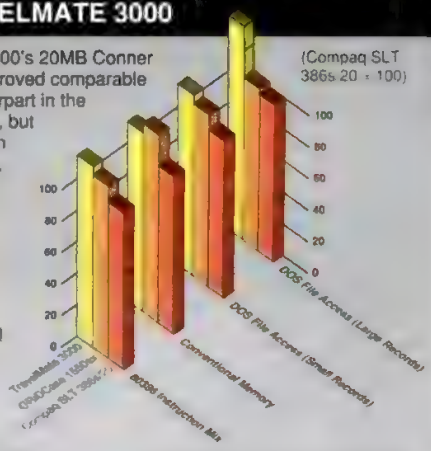
However, the TravelMate 3000's lightweight plastic casing sacrifices ruggedness and durability for a couple of ounces. The TravelMate 3000 simply isn't as rugged as Compaq's LTE 386s/20. It would be a more trustworthy TravelMate were it made of a heavier-gauge plastic cover, or better still, a magnesium case like the GRiD 1550sx. ■

List price: TravelMate 3000, $5,499. Texas Instruments Inc., Information Technology Group, P.O. Box 202230, ITG-065, Austin, TX 78720-2230; (800) 527-3500.

CIRCLE 711 ON READER SERVICE CARD

BENCHMARK TESTS: GRIDCASE 1550SX, TRAVELMATE 3000

The TravelMate 3000's 20MB Conner Peripherals drive proved comparable to its 60MB counterpart in the GRiDCase 1550sx, but neither could match Compaq's optional, sub-18-millisecond 120MB drive, whose performance is among the fastest of any laptop. Both machines scored within the expected range for 20-MHz SXs on our processor benchmarks.



The **80386 Instruction Mix** benchmark test times a series of tasks specific to the 80286 chip. Since this test shows how the CPU operates in the context of the bus, processor, system memory, and motherboard architecture, a faster time means better overall computer performance

The **Conventional Memory** benchmark test measures the read/write speed of the first 640K of memory. Slower relative times can indicate the presence of memory wait states or memory chips rated at slower access speeds

The **DOS File Access (Small Records)** benchmark test times disk throughput as a result of mechanical disk drive speed, hard disk controller function, and bus speed. The test is performed without software disk caching. Fast times are advantageous for programs that work with many short segments of data

The **DOS File Access (Large Records)** benchmark test times disk throughput as a result of mechanical disk drive speed, hard disk controller function, and bus speed. This test minimizes the effect of small hardware caches on disk subsystem performance. It is performed without software disk caching. Fast times are advantageous when large files are loaded

Performance Times (Times given in seconds)	80386 Instruction Mix	Conventional Memory	DOS File Access (Small Records)	DOS File Access (Large Records)
TravelMate 3000	3.57	0.47	66.14	7.54
GRIDCase 1550sx	3.40	0.49	61.01	5.77
Compaq SLT 386s/20	3.11	0.41	59.74	5.58

CONTINUED FROM PAGE 33

GRiDCase

one hour and 35 minutes in the battery rundown test (run with all power conservation features disabled), roughly half the battery life of Compaq's SLT 386s/20. You can conserve power in a variety of ways, including blanking the LCD screen after a period where nothing is entered on the keyboard, and cutting power to individual components such as the hard disk and modem.

Once you settle down to work, though, you quickly forget these shortcomings and thoroughly enjoy the unit's long list of features. The exceptionally bright and sharp VGA LCD screen, the 2MB of RAM in the base unit, the built-in 3.5-inch floppy and 60MB Conner Peripherals hard disk let you run virtually any application. Other features such as the two serial ports, one parallel port, a VGA port, ports for a full-sized keyboard and a numeric keypad, and the inclusion of *Windows* 3.0 and *386Max* software let you use this machine as a powerful desktop system.

Options include a 120MB hard disk, 2- and 6MB memory upgrades, and a 2,400-bps modem. GRiD plans to introduce a SCSI port early next year that would plug into the slot currently reserved for the battery pack.

GRiD will also offer an external CD-ROM drive that will plug into the port and mount to the top of the 1550sx behind the LCD screen. The benefits of having a CD-ROM drive to use with a laptop computer are tremendous for those who need access to vast amounts of data.

The most intriguing element of the 1550sx is the Isopoint control bar. The Isopoint, built into the front of the machine, is a combination rotating wand and four buttons that perform the same functions as a mouse. Roll the Isopoint with your fingertips to move the on-screen arrow. Depress the Isopoint bar or use four buttons to perform a mouse click. A press on a button coupled with a rolling of the bar is the equivalent of a dragging motion. Remarkably intuitive, it takes only a few minutes before you're working.

Another ergonomic design is used for the power supply. An opening on the back of the 1550sx accepts the nickel cadmium battery or the AC power supply. Other laptop computers use an external power supply. If you know you don't need the battery, you can leave it at home and keep the AC power supply tucked in the 1550sx instead. (The AC power supply can also be connected externally when charging the battery.)

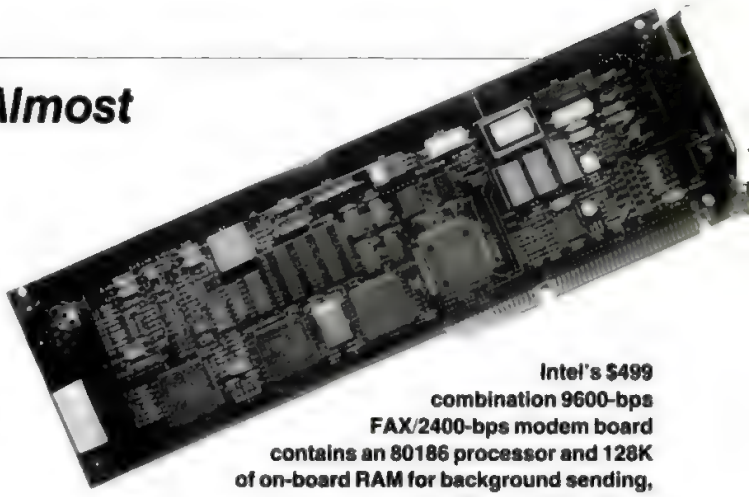
Typing is pleasurable on the 1550sx's 77-key keyboard. Keys have a solid feel and there's plenty of spacing between keys.

Between the Isopoint, *Windows* 3.0, its large capacity drive, and magnesium case, no other laptop computer stands up to the demands of traveling better than the GRiDCase 1550sx. But the durability and power may be overkill for most users, who would do better to select a smaller and less-expensive laptop computer. ■

List Price: GRiDCase 1550sx, $6,195. GRiD Systems Corp., 47211 Lakeview Blvd., P.O. Box 5003, Fremont, CA 94537-5003; (800) 222-4743.

CIRCLE 706 ON READER SERVICE CARD

Intel SatisFAXtion Board: An Almost Perfect FAX/Modem Board



Intel's $499 combination 9600-bps FAX/2400-bps modem board contains an 80186 processor and 128K of on-board RAM for background sending, polling, and receiving.

Intel's $499 SatisFAXtion Board comes close to being the perfect fax board—so close, in fact, that you'll either happily overlook its minor flaws or become despondent at the thought of coming so close yet remaining so far from perfection. The board combines a 9,600-bps fax modem with a 2,400-bps MNP data modem. It has the best-engineered hardware on the market, and the most foolproof, automatic installation. The price is exceptionally low. The problems are in its software, and many will be fixed by the time you read this.

The standard-bus version of SatisFAXtion is a 16-bit board that works in any 8- or 16-bit slot. A functionally identical $549 version for MCA machines is on the way. Unlike other fax boards, this one doesn't make you set switches to choose the COM port for the modem or to adjust the I/O address for the fax board. A switchless installation process figures out which COM port is available on your system and sets up the board for you, although you can make manual adjustments any time you want. An 80186 processor and 128K of on-board RAM allow for true background sending, polling, and receiving.

SatisFAXtion is the successor to Intel's Connection CoProcessor fax board. The software is enhanced; the modem is built-in instead of optional. Like the Connection coprocessor, the SatisFAXtion board supports the CAS specification for exchanging information between applications and communications hardware.

While comparable boards bristle with plug-in modules, Intel fits everything on the board without crowding. The mounting bracket has a port for an optional $399 Logitech-designed hand-scanner, which Intel plans to release sometime in November.

Intel's software for sending faxes from within applications differs from virtually everything else on the market. You don't use a hotkey to pop up a special TSR. Instead, you load (at boot-up) a pair of drivers that take up 12K of conventional RAM if you have EMS or XMS memory, or 74K if you have only conventional RAM. You select your application's Epson FX85 (or plain ASCII) printer driver and set it to print to LPT3 (or another port that you can specify from the DOS command line—although if you specify your standard printer port, you'll send a fax instead of printing).

When you tell your application to print to the specified port, a pop-up screen appears. The screen prompts you for the destination phone number (which you can select from a phone book), optional text for a cover page, and the time you wish to transmit. The software then converts the printer output to a fax and sends it at the specified time. The output is excellent, with font and graphics often superior to those on a real Epson printer.

FACT FILE

SatisFAXtion Board
Intel PCED
5200 N.E. Elam Young Pkwy., Hillsboro, OR 97124-6497; (800) 538-3373, (503) 629-7000
List Price: $499 ($549 for Micro Channel machines).
Requires: DOS 3.0 or later, 640K RAM, 10MB hard disk space.
In Short: A combined 9,600-bps fax board and 2,400-bps MNP modem with superb installation and well-designed but slightly buggy software.

CIRCLE 707 ON READER SERVICE CARD

The fax pop-up uses IRQ 7 to detect when to pop up. This interrupt is also used by other packages, including LaserTools' popular *PrintCache*. If you plug the SatisFAXtion board into a 16-bit slot, you can choose the rarely used IRQ 10 or 11 to avoid most possible conflicts.

The pop-up software won't work with *Windows* in protected mode. You can use Alien Software's *FAXit* for faxing from *Windows* applications. *FAXit* is available when you send in a coupon that comes with the SatisFAXtion board. *FAXit* can't use the same phone books as the SatisFAXtion board, but you can merge the SatisFAXtion phone books into *FAXit*'s software. I kept getting error messages when I did this, but Intel said I could ignore them, and no actual problems occurred. Another coupon included with the box gets you a copy of *PC Tools Deluxe*.

If you want to fax ASCII or .PCX files, or transfer files directly to another SatisFAXtion board, you can use the board's standalone software, which is an improved version of the awkward software that came with the Connection CoProcessor. The graphics viewer, however, is still licensed from ZSoft. It suffers from a hopelessly awkward interface that demands a mouse or relegates you to using the Arrow keys at an excruciatingly slow pace.

You can print individual faxes using the main fax software or use a separate program to print all received faxes in an unattended mode. You can't print faxes in the background, however.

The only serious problems I encountered with the SatisFAXtion board involved its MNP modem. But because the modem downloads its "firmware" from your hard disk on boot-up, these problems can be fixed with software updates. Intel has already fixed the worst bug, which made my computer occasionally lock up when using the MNP protocol. Other bugs, which limited connect speed with US Robotics 9,600 modems and messed up some transfers using the Zmodem protocol, were being swatted at the time of this review.

If the file DOWNLOAD .IFP in the fax directory is dated 14 September 1990, you have the original buggy software. Turn off MNP by entering the following command in your communication software: AT \N0 &W.

When you get an improved version of the file from the toll-free tech support (Intel can transfer it directly to the SatisFAXtion board), turn MNP back on by entering the same command with \N3 instead of \N0. The manual is less than helpful in dealing with problems like this.

No computer hardware is fully satisfying, but the SatisFAXtion board combines major satisfactions with minor and correctable frustrations. ■

Plus Brings Hypercard, Hyperprogramming to Windows 3.0

HANDS ON
By Richard Hale Shaw

Some of the hoopla surrounding the announcement of *Windows* 3.0 was actually about Asymetrix's *ToolBook*, which brought a hyperprogramming environment to *Windows* (First Looks, July 1990). While Microsoft's endorsement certainly doesn't hurt *ToolBook*'s prospects for acceptance, the software has limitations, including severe speed problems. *Plus* 2.0 from Spinnaker Software has come forward to exploit this opportunity.

A $495 object-oriented development tool for *Windows* 3.0, *Plus* offers a superset of *HyperCard*, as found on the Macintosh, and maintains complete *HyperCard* compatibility. Spinnaker also sells *Plus* for the Mac, and *HyperCard* stacks run in either *Plus* environment without modification. But *Plus* also has features *not* found in *HyperCard*—or in *ToolBook*, for that matter.

Plus for *Windows* takes its cue from the Macintosh—even the traditional *Windows* hourglass has been replaced with the Macintosh wristwatch icon.

While pull-down menus are available for most options and tools, you'll also find that a toolbox bar contains icons for all of the tools you'll need to build stacks, cards, and assorted objects. And, as you select objects and work at different levels, the ToolBar changes. So you don't have a whole bunch of palettes and windows floating around as you do with *ToolBook*. You may find this intimidating at first, but after a while the iconic approach becomes natural, intuitive, and fast.

HyperCard, after which *Plus* is patterned, is not complex. It relies on an index-card metaphor, and applications are composed of groups of stacks (like *ToolBook* books). Each stack is in turn made of cards (like *ToolBook* pages). A card can contain buttons, fields, and graphics objects, which appear in a single window, and a card can be up to 32,000 pixels high or wide. You typically keep associated information in a single stack of cards, and create links between any cards in a stack or between stacks.

Plus stacks are manipulated by writing scripts in the English-like *Plus* Programming Language (PPL), and each object (card, button, field, etc.) can have a controlling script. The scripts contain handlers or functions that are triggered by the receipt of messages. And, you can create library stacks to share functionality with more than one stack.

Plus's drawing and painting facilities stand out as its most significant feature (a feature that *ToolBook* lacks). You can create and manipulate graphics objects, with seven different line-drawing thicknesses and 32 different brush shapes. You can paint, draw, and fill objects, create unusual fill effects, invert the colors of an object and even rotate an object.

There are no problems importing large objects (*ToolBook* limits these to 64K per page). I imported a 140K paint object quickly and effortlessly. Like *ToolBook*, *Plus* allows you to link one object to another, so clicking on an object can move you to a different card or stack, and you can animate an object's movements, even setting the movement speed.

Plus makes it easy to create scripts. The script editing window offers four pull-downs, two of which are specifically for writing script handlers. The Macro pull-down contains a list of messages; select one, and *Plus* inserts an outline of that message's handler at your cursor location in the window, then positions your cursor in the handler for editing—it's terrific! The Syntax pull-down generates lines of PPL to be inserted, so there's little room for wondering which commands are available and what their syntax is. And you won't have to worry about saving your stacks regularly as you develop them. *Plus* does this automatically at user-defined intervals.

While *Plus* doesn't let you access *Windows*'s DLLs (as does *ToolBook*), you can use XCMDS (as in *HyperCard*) to extend your applications. And *Plus* also offers software slots, a facility that lets you create your own customized objects and tools, which become part of the *Plus* environment—even to the point that they are added to the ToolBar. Thus, you can create your own customized objects, and add them to the *Plus* vocabulary. A *Software Slots Development Kit* is available from Spinnaker ($695).

Plus has a few problems: I had to use a workaround to install the product, as none of the documented install commands worked. And compatibility with the Macintosh version sometimes gets out of hand. The documentation has screen shots that are obviously from the Mac version. No big deal, but disconcerting. Also, the accelerator keys are those found on the Macintosh. I would have preferred an option to use the *Windows* accelerators. Finally, *Plus* does not work in *Windows* Real mode. You'll need at least an AT-compatible or higher to run *Plus* in *Windows* Standard or Enhanced mode.

The runtime package is royalty-free and there are no limits to distribution, but it costs an extra $495. If you're on a tight budget, you may want to consider *ToolBook* ($395 total, since the runtime is included with *Windows*—for the time being). But if you're looking for a powerful, intuitive, feature-packed opportunity to develop *Windows* applications without C programming, put your money down on *Plus*—you won't regret it. ■

Like *HyperCard* on the Macintosh, *Plus* uses the card metaphor. Included with *Plus* are ready-made stacks such as Office Plus, which has an appointment calendar, a "To Do" list, and a notepad.

FACT FILE

***Plus*, Version 2.0**
Spinnaker Software, 201 Broadway, Cambridge, MA 02139, (617) 494-1200
List Price: $495; runtime version, $495.
Requires: 80286 processor or higher, 2MB RAM, 2MB hard disk space, *Microsoft Windows* 3.0, DOS 3.1 or later
In Short: A powerful, feature-packed hyperprogramming environment, with full *HyperCard* compatibility, and a great graphics drawing environment. Costlier than the competition for both the base package and runtime version, *Plus* offers better performance and a more intuitive, extensible environment

CIRCLE 710 ON READER SERVICE CARD

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- ☐ Baskerton
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- ☐ Corporate Condensed
- ☐ Courier
- ☐ Eterna
- ☐ Futuri
- ☐ Garamand
- ☐ Garamand Condensed
- ☐ Gazette
- ☐ Gibraltar
- ☐ Jewel
- ☐ Joulliard
- ☐ Katrina
- ☐ Letter Gothic
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- ☐ Padua
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- ☐ Dateline
- ☐ Dateline Condensed
- ☐ Diner Script
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CIRCLE 299 ON READER SERVICE CARD

Quattro Pro 2.0 Adds Rich Presentation Features

HANDS ON

The latest version of *Quattro Pro* adds tight integration with Borland's *Paradox* database, three-dimensional graph types, the ability to create "hypershow" slide presentations, and a host of small improvements to its already feature-rich spreadsheet.

Apart from the inclusion of a simple goal-seeking utility (comparable to *Lotus 1-2-3/G*'s Backsolver), *Quattro*'s underlying analytical engine is unchanged. Both the performance and the basic spreadsheet feature set of Version 2.0 are identical to those of Version 1.0. But if either *Paradox* connectivity or presentation values drew you to *Quattro Pro* initially, you'll probably find more than enough here to justify an upgrade.

Quattro Pro is now much more tightly tethered to *Paradox*. If you own *Paradox* 3.5 or later and have 2MB of extended memory (*beyond* the RAM needed for *Quattro Pro*), you can run *Quattro Pro* 2.0 as a subtask within *Paradox*. Simple keystroke combinations (and a new *Paradox* PAL statement) allow you to maintain context in both programs as you toggle from one to the other.

If you also own Borland's separately sold *SQL Link*, you can use the new *Quattro Pro* as a seamless front end to SQL data residing on networks, minis, or mainframes.

For the *Paradox*-committed, Borland's approach to database outreach makes sense. As *1-2-3*, Release 3, has shown, it is possible to use spreadsheet-style database commands to perform relational operations and queries on external tables. But *1-2-3*'s commands are keystroke-intensive compared with the simplicity of *Paradox*. With the *Paradox/Quattro Pro* combo, you can divvy up the labor efficiently, doing arithmetic and graphical analysis in the spreadsheet and leaving the table manipulation to *Paradox*.

On the other hand, both Lotus (with Release 3 and *1-2-3/G*'s DataLens interface) and Microsoft (with *Q+E*) offer more general solutions. With these programs you just plug in the correct driver and your spreadsheet can talk to any (supported) database.

Quattro Pro's graphics repertoire now includes three-dimensional bars, lines, areas, and "step" graphs (3-D bars which have no space between the bars). These are not three-axis graphs, but ordinary two-axis types in which multiple data series are plotted behind one another and displayed in three-dimensional perspective.

More importantly, *Quattro Pro*'s Annotator (a mini-drawing package and slideshow) now allows you to put "hypershow" buttons on graphs and slides. These are ordinary text fields that have been assigned either to the names of other graphs or to macros. When the viewer clicks a button, control is passed to the named graph or the associated macro.

FACT FILE

***Quattro Pro*, Version 2.0**
Borland International, 1800 Green Hills Rd., Scotts Valley, CA 95066; (408) 438-8400.
List Price: $495 (upgrade from 1.0: $79). If you use another spreadsheet, you can get a competitive upgrade to *Quattro Pro* for $99
Requires: 512K, standalone; 640K on network (*Paradox* Access feature requires an additional 2MB of extended memory).
In Short: The salient features of this modest upgrade are tighter integration with *Paradox*, three-dimensional graph types, "hypershow" buttons, and better import/export with *Lotus 1-2-3*, Release 2.2.

CIRCLE 704 ON READER SERVICE CARD

With relatively modest effort, the *Quattro Pro* user can now create easy-to-use executive information systems (EIS), in which the executive can click a button to get more detailed numbers or a different cross-sectional perspective—or whatever. The same techniques can be applied to slide sequences, making formal presentations more responsive to audiences' interests and questions.

Slidemakers will also appreciate the ability to import logos and other clip art stored in .CGM files. Borland provides a modest clip-art library with *Quattro Pro* (additional images are available), but 2.0's support of the .CGM format means that users can import *Lotus Freelance Plus* and *Harvard Graphics* images, too.

As a further boon to presenters, the new version allows graphs to be copied from one worksheet to another. If the graph is data-driven, the copying process automatically creates the appropriate file-link formulas. If it's entirely text, it's simply duplicated in the destination file. Since slideshow sequences are controlled by data in an ordinary *Quattro Pro* worksheet, this copying capability greatly simplifies the reuse of text slides in multiple presentations.

Meanwhile, back on the spreadsheet grid, *Quattro Pro* now offers full diplomatic relations with *1-2-3*, Release 2.2. File-linking commands in .WK1 files are automatically converted to *Quattro Pro*'s syntax on import, sparing users the need to run their own translation macros. Simple file-link formulas exported to *Lotus* can be either translated (for the benefit of 2.2 users) or converted to their current values (for 2.01 users). More complex links are always converted to values on export since Release 2.2 does not support them.

Those with good eyesight and the need to see a year's worth of columns at a glance will be glad to learn that *Quattro Pro* supports 132-column VGA display systems from a number of vendors. Unfortunately, the program doesn't prevent you from invoking one of these display modes when your hardware doesn't support it, thereby turning your screen to garbage.

Network users will be grateful that 2.0 can store bitmapped font files and menu-tree (MU) files in a shared server directory, eliminating redundant disk consumption.

All in all, this is an upgrade full of modest but useful improvements. From a strictly spreadsheet perspective, it's nothing to get excited about. But most users of 1.0, and especially formal presenters, will find at least one or two enticements in 2.0. ■

***Quattro Pro*'s "ribbon" graph is one of four new three-dimensional graph types. The new version also includes hypershow capabilities and a tight link with *Paradox*.**

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TEXAS INSTRUMENTS

CIRCLE 499 ON READER SERVICE CARD

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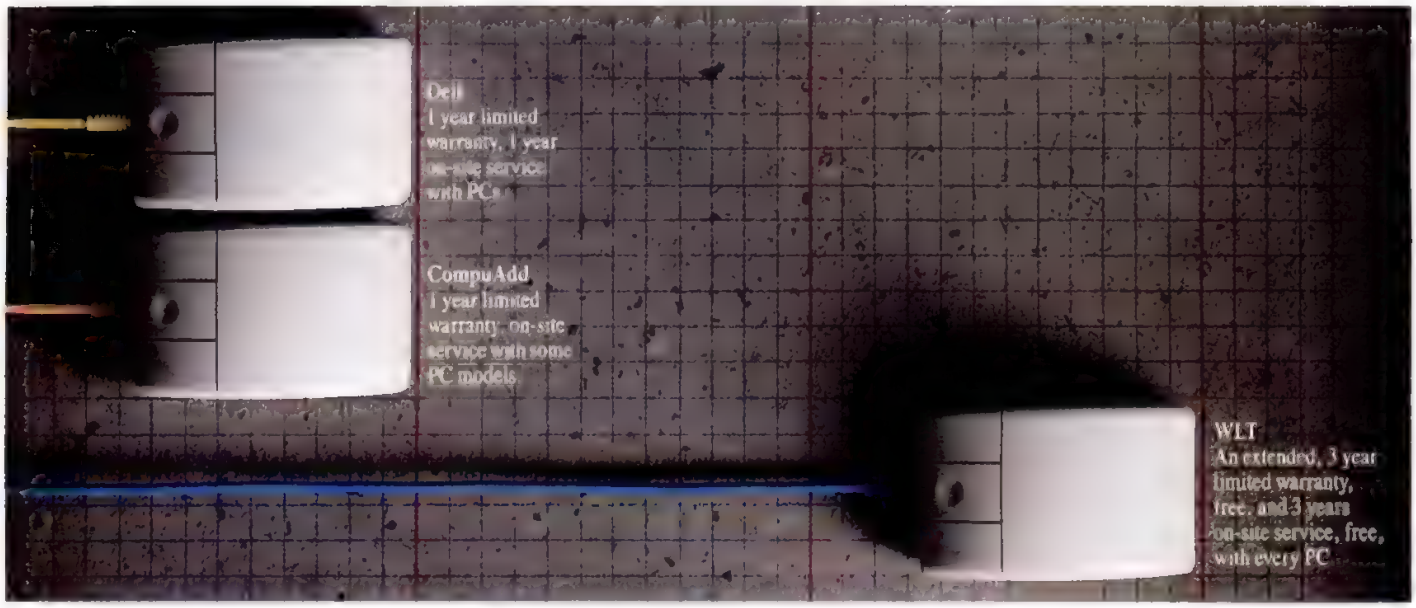

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CIRCLE 350 ON READER SERVICE CARD

Adobe Type Manager Makes Type 1 Fonts Available to Screen and Printer

HANDS ON
by Edward Mendelson

Scalable on-the-fly screen and printer fonts for *Windows* have become the rage. Just a few weeks after Bitstream released its $99 *FaceLift* (First Looks, November 27, 1990), Adobe now offers its long-awaited $99 PC version of *Adobe Type Manager (ATM)*, ported from the Macintosh. More entries from Zenographics and AGFA Compugraphic are pending.

Adobe's utility comes with 13 scalable fonts and provides the simplest, most transparent way to add scalable fonts to virtually any *Windows* printer and display screen. Unlike *FaceLift*, which uses only the 200 typefaces available in Bitstream's new Speedo font format, *ATM* builds screen and printer fonts from any of the hundreds of Type 1 PostScript soft fonts available from Adobe and many other vendors.

In addition to providing PostScript fonts on screen, *ATM* uses PostScript typeface outlines to create bitmap fonts for non-PostScript printers. This means that dot matrix and LaserJet users can print text that, within the hardware limits of their printers, is identical to the text printed on PostScript printers. Because *ATM* is a second-generation PostScript font rasterizer, the PostScript text it produces on a LaserJet is sharper and clearer than the text produced by printers like the Apple LaserWriter IINTX which use Adobe's first-generation PostScript interpreter.

Neither *ATM* nor *FaceLift* affects graphics printing. You still need a PostScript printer (or software PostScript interpreter) to print .EPS files. Although both *ATM* and *FaceLift* work with most *Windows* printers, *FaceLift* can't create printer fonts on the fly for LaserMaster printers; *ATM* can.

If you use *Windows* 3.0 in standard or enhanced mode, you don't have to choose between *FaceLift* and *ATM*, for the two coexist transparently in the same system. If you use *Windows* in real mode or *Windows* 2.x, you can't use *ATM* at all; you can use *FaceLift*.

The amount of RAM taken up by each program depends on the nature of your computer system. On a 386 with 8MB of RAM, *FaceLift* needs about 60K in its default setting, and *ATM* about 240K.

ATM comes with the original 13 PostScript fonts—four weights each of Times Roman, Helvetica, and Courier, plus Symbol. A $198 *Plus Pack* has the remaining 22 fonts needed to match the 35 in most PostScript printers.

More than 750 other hinted Type 1 soft fonts are available for the PC from Adobe, Monotype, and Linotype. *ATM* also works with the hundreds of unhinted third-party Type 1 fonts available from Image Club and other sources, but the printed output will be rougher than with hinted fonts. Even among hinted fonts, you're likely to notice a difference between Adobe's fonts and those from other vendors. When printing to a LaserJet using *ATM*, for example, Adobe fonts tend to have smoother edges and more consistent line widths than the less extensively hinted fonts from Monotype.

ATM is designed to be installed and then forgotten. Compared to the of adjustments available in *FaceLift*, ATM's control panel offers a minimum set of options. You can turn *ATM* on or off, adjust the size of the memory cache in which *ATM* stores bitmap fonts during the current *Windows* session, and add more Type 1 fonts.

ATM doesn't give you fine adjustments for dot matrix printers like *FaceLift*, and doesn't give you a *Windows*-based option to build standard LaserJet soft fonts to use for faster downloading. Adobe's recent repackaging of its Type 1 soft fonts, however, includes a separate DOS-based utility that creates bitmap fonts for the LaserJet from any Type 1 font.

FaceLift has an option to create a disk file containing a cache for its bitmapped fonts, so you can display files quickly without waiting for screen fonts to be regenerated in each session. *ATM* doesn't have a disk-based cache, and the delay in creating fonts can be annoying on a slow system, although unnoticeable at 25 MHz or faster.

Like *FaceLift*, much of *ATM*'s screen performance depends on the underlying application. When you use on-the-fly screen fonts, *Word for Windows* and *Ventura Publisher* distractingly rewrite the screen after almost every character you type. *Ami Professional* waits for a pause, generally at the end of a line; *PageMaker* rewrites constantly and without any annoying flicker.

Bitstream has announced a version of *FaceLift* that uses Speedo fonts with *WordPerfect*. Adobe has no immediate plans for comparable DOS-based versions of *ATM*, but hasn't ruled out the possibility of releasing them in the future.

When Adobe started issuing typefaces five years ago, its designs were less vigorous and less carefully detailed than Bitstream's, but Adobe's more recent designs have been closing the gap. Desktop typographers can now enjoy both Adobe's and Bitstream's designs on the same screen and the same page.

Don't waste time choosing between *ATM* and *FaceLift*. Get both. If you can only choose one, and you don't already have a directory full of Bitstream fonts, *ATM* gives you access to the widest range of type designs with the greatest transparency and ease. ■

Adobe Type Manager's control panel lets you change the cache size or use preexisting soft fonts, but normally you just install the program and use it with virtually any *Windows* application.

FACT FILE

***Adobe Type Manager*, Windows Version**
Adobe Systems Inc., 1585 Charleston Rd., Mountain View CA 94039; (800) 833-6687, (415) 961-4400.
List Price: $99.
Requires: 1MB RAM (2MB recommended); hard disk; 286, 386, or greater processor; *Windows* 3.0; *Windows*-compatible printer and monitor; DOS 3.1.
In Short: On-the-fly screen and printer fonts for *Windows* using Type 1 PostScript fonts—the most widely available typefaces on the market for PCs

CIRCLE 702 ON READER SERVICE CARD

SPC's InfoAlliance: Large-Scale Solution For Data Integration

HANDS ON
by Joe Salemi

Billed as the first "Data Source Integrator (DSI)," Software Publishing Corp.'s OS/2 1.2-based *InfoAlliance* brings a new approach to the Client/Server model of network computing. SPC coined the term DSI to describe a class of applications whose primary function is to integrate data transparently from unrelated sources, and present that data to the user in a coherent, easy-to-use format.

As a data integration system, *InfoAlliance (IA)* has many features in common with SQL database front ends; however, it also has functions that would qualify it as a database server. It would also serve quite well as the basis for an Executive Information System (EIS).

This release supports direct reading and writing of *dBASE III Plus* and *dBASE IV* data files—currently the most common PC database file formats; it also reads and writes IBM OS/2 Extended Edition *Database Manager* server files, and the *IA* native format. It imports and exports data from *Lotus 1-2-3*, *Professional File* 2.0, ASCII, and .DIF files, and can export *Harvard Graphics* .CHT files.

All external data access is handled either directly by the user or is under the control of an *IA* application. Support for Microsoft's *SQL Server* and mainframe-based *DB2* (through the Micro Decisionware Database Gateway) is planned.

The *InfoAlliance* system consists of three modules. The Network DSI Server runs on any 80386 OS/2-based workstation or file server on the LAN, and performs the actual data retrieval. The DSI server functions as both a database server and an interface to other database servers. Included with the server software is a PM-based DSI Server Administration program that lets the administrator set user access to seven security levels, configure the server, and also offers status information regarding user and file access, as well as transaction management.

The second module is the *InfoAlliance* Design Edition—a souped-up forms design environment with querying capabilities, used to create *IA* forms, reports, and applications. All programming is done through a PM-based applications generator using pull-down menus, dialog screens, and DTP-type forms design; the programmer never has to write a line of code.

Existing paper forms can be scanned into Design Edition and used as an on-screen template for the data form. An on-screen data form can incorporate graphics, multiple fonts, and shading, mimicking its hard copy counterpart. Applications created by the programmer also use pull-down menus and submenus to call different forms or functions.

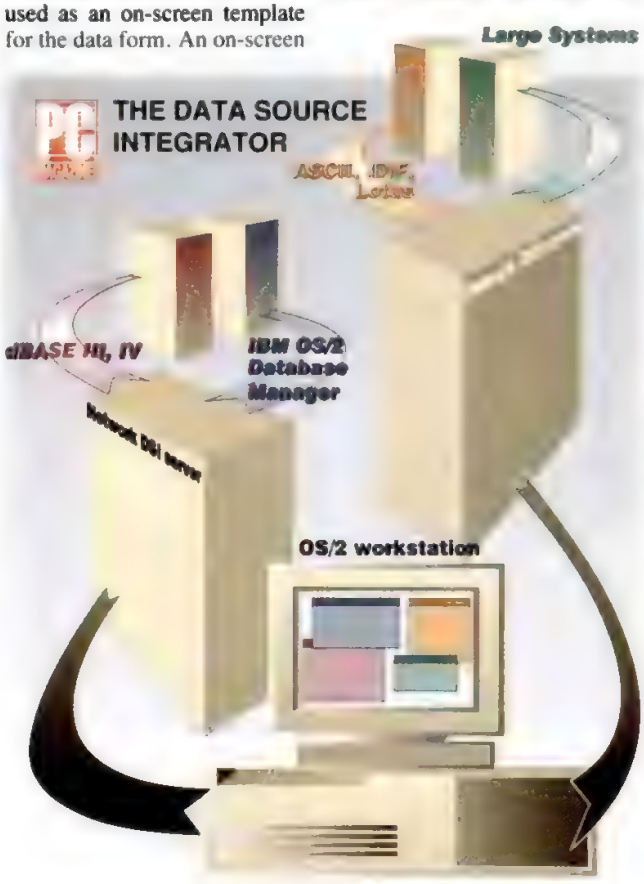
The third module, *InfoAlliance* Access (Access is also included in Design Edition), is the PM-based client portion that runs *IA* applications and queries on the workstation. Access gives you the benefits of a GUI—different data files can be presented in different windows, and the user can fill in a form by cutting and pasting data from them. A table view of the data is also available.

On-screen icons provide functions such as paging through records, changing between form and table views, and searching. Access is well integrated into PM—the user can do almost everything with the mouse.

InfoAlliance supports the IBM *LAN Server*, *Microsoft LAN Manager*, and *NetWare* with OS/2 Requestor LANs. It will also run on a 3Com *3+Open* 1.1 network, but it requires the still-in-beta-testing OS/2 1.2 drivers. You can also install the server module in "local mode" on a standalone system; this lets you begin using *IA* and developing applications prior to large-scale installation.

InfoAlliance is available through certified VARs offering several levels of on-site support. SPC is well known for its easy-to-use DOS programs. *InfoAlliance* continues the ease-of-use tradition, but in a more complex environment. It combines elements of groupware, forms processing, a GUI environment, and a database server.

Even though *InfoAlliance* is resource intensive and can be quite expensive, any company looking for a method of tying together different pieces of data, while offering end users an easy-to-use application, should give *IA* a close look. ■



***InfoAlliance* functions as a transparent interface system to different data sources. The Network Server DSI acts as the middleman, culling data from a number of applications and formats.**

FACT FILE

InfoAlliance
Software Publishing Corp., 1901 Landings Dr., Mountain View, CA 94039-7210; (415) 962-8910.
List Price: 10 client/1 server configuration, $8,500; 200 clients and 9 servers is $99,500
Requires: 80386 or higher; OS/2 1.2 or later, 2MB RAM (above base system requirements) per module loaded recommended.
In Short: An application system that combines elements of groupware, forms processing, and a distributed database environment. A strong first step to deliver on the promise of the OS/2 Presentation Manager and the Client/Server architecture

CIRCLE 706 ON READER SERVICE CARD

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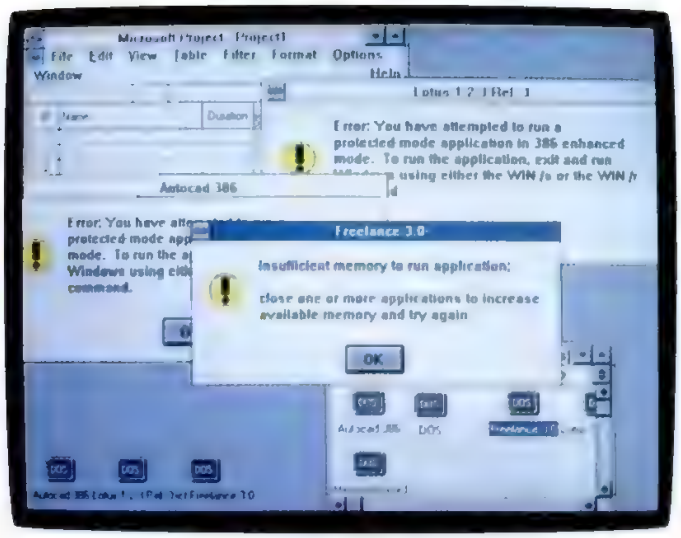
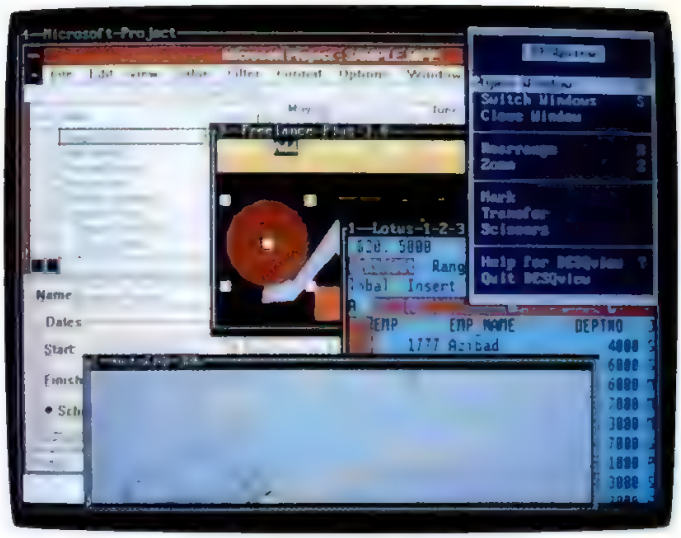


Windows 3.0. The multitasking, windowing environment.



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This comparison was made using a system like the one you might run: Both shots show an ALR FlexCache 33/386 running DOS 3.3 with VGA display adaptor, Novell NetWare v3.01 Rev. A, with IPX/SPX v3.01 Rev A, Microsoft Mouse 7.00, and Microsoft SMARTDrive v3.03 disk cache. Buffers were set to 20. For the Windows screen, we ran Microsoft Windows 3 HIMEM.SYS and EMM386.SYS. For the DESQview screen, we ran QEMM 386 v5.1.

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CIRCLE 338 ON READER SERVICE CARD

Lightship Brings Low-Cost EIS to the Desktop

HANDS ON
by Barry Simon

Pilot Executive Software's *Lightship* is a *Windows* 3.0-based, Executive Information System (EIS) toolbox that sells for $795. This is especially significant if you consider that Pilot—a leading player in the EIS market—staked the territory with turnkey versions of its *Command Center* product that costs anywhere from $150,000 to $200,000.

EIS is a seductive idea—you bring executive-level information from many data sources to a front-end system that stresses a graphic/bottom line approach. A typical example might be a display showing a map of the United States. Click on a state and launch the weekly sales figures for that state; click on one of those figures and get the data-driven details that went into producing them. The data is updated regularly in its native format, but linked to the EIS system.

The visual elements of a *Lightship* screen include text strings, data, bitmapped graphics, charts, and line art. *Lightship* provides tools for creating documents, charts, simple images, or hotspots (areas that contain underlying detail); the data elements reside in external applications.

While in author mode, a few mouse strokes can create a "button" so that when a user clicks on that number, a subsidiary screen pops up. Buttons can be transparent regions that are indicated as the mouse cursor changes into a hand, real buttons drawn with drawing tools, or graphic images that you transform into buttons.

Although a *Lightship* presentation has both flow and branching capabilities, creating a presentation requires no formal programming. Instead, you choose one or more actions from a scrollable list. For example, you could choose to display a retrace path of previously viewed windows or branch to an entirely new screen.

And even though there is no formal programming necessary, there are variables. For example, a button could change the value of a variable; data displayed on a screen would be dependent on the current value of that variable. Also, at runtime, data can be color-coded depending on whether it fits into certain ranges.

An especially lucid tutorial and some sample applications make learning the basics easy. Making a transparent button that will drill down to a screen with detail is as simple as picking the hotspot icon from the toolbox (or from a menu), drawing a box around the desired hotspot with the mouse, and picking "Open file" from the dialog box that pops up after you've drawn the hotspot.

Much of the substance of the *Lightship* environment comes via the wonders of *Windows*' DDE (Dynamic Data Exchange) protocol for communication between *Windows* programs. DDE lets you request data from other *Windows* programs and have that information appear in your program, so long as that data is text or bitmapped graphics. DDE is supported using the *Windows* Paste linking command.

Bringing live data into the *Lightship* environment is as easy as starting the external program, cutting the data to the clipboard, and pasting-linking it into *Lightship*. The next time *Lightship* is run it will automatically start the other application and update the data.

DDE Execute commands—which let you send complex commands to an application that supports DDE as a server—are also supported, but using them requires some sophistication. Neither DDE Poke nor any of the DDE server commands are supported.

At the author level *Lightship* lets you invoke a toolbox and interact with a slick *Windows* interface. In the background, the hotspots are highlighted.

In spite of its exciting potential and a solid overall conception, *Lightship* falls short on its execution of some details. The only ways to bring data into *Lightship* are via DDE or as straight ASCII files. Lotus spreadsheet information needs to enter through *Microsoft Excel*, *Wingz*, or a manually created .PRN file. Pioneer Software's *Q+E* provides DDE links to *dBASE* files, but there is no way to read *Paradox* files short of making an ASCII report to disk.

Lightship's on-screen data formatting is amateurish. For example, you have to adjust column widths by typing in numbers rather than using the mouse to drag column lines. And when you adjust the size of a data window, your numeric formatting becomes undone.

The worst limitation is lack of support for imported vector graphics. This limits imported graphics to *Windows* bitmaps and .PCX and means that the program's graphing module, which offers standard-issue pies and bars, can only be supplemented with bitmapped imports. Bitmapped imports will not resize or translate to other displays as well as their vector-based counterparts. The built-in drawing tools include ellipses, rectangles, polygons, and lines, but not curves. Editing is also limited; there's no way to change the shape of a polygon by moving a single node.

Lightship is the first lower-cost EIS software, but it will surely not be the last. You should also consider other routes to creating an EIS system. With a little more programming effort you could use *ToolBook*; SPC's *InfoAlliance* is reviewed in this issue's First Looks section. And the step from some of the new graphics presentation environments to EIS is not so large.

Because Pilot Executive Software does not offer runtime versions of *Lightship*, these other options may be more economical. For now though, if your data is in a format that *Lightship* can access and you are willing to cope with some limitations, *Lightship* will give you spectacular linked presentations on your desktop. ■

FACT FILE

***Lightship*, Version 2.0**
Pilot Executive Software, 40 Broad St., Boston, MA 02109; (617) 350-7035.
List Price: $795.
Requires: *Windows* 3.0, 2MB of RAM (4MB or more recommended), mouse.
In Short: EIS comes to the desktop in an easy-to-use toolkit, even though the individual modules are spotty.

CIRCLE 431 ON READER SERVICE CARD

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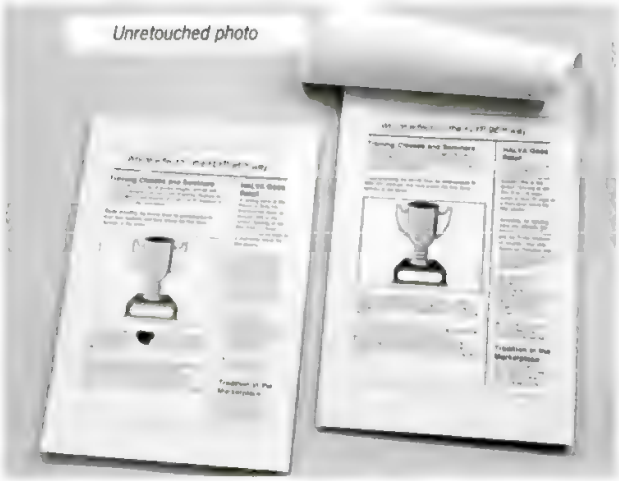

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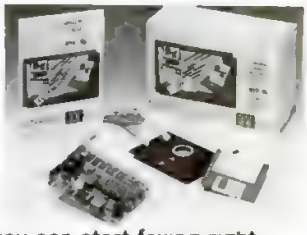

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First Looks

Hijaak's New Image

HANDS ON
by Luisa Simone

Most anyone who's worked with graphics files has been grateful for *Hijaak*'s simple DOS-prompt command "Convert," which reads graphics files in one format and spits them out in another. The newest version of this $199 graphics utility adds ten new vector formats, and four new raster formats to handle conversions to and from a broad spectrum of file types and 19 different fax formats.

Even more impressive is *Hijaak* 2.0's ability to read and write specific file format flavors. You can have confidence that the .CGM file you create for *Freelance Plus*, or the .TIF image for *PageMaker* will work with the target application.

This release also adds sophisticated image processing. When you reduce a 24-bit Targa file to a 256-color .PCX file, you can choose between dither or diffusion methods. In addition, you can either force the image to gray scale or black and white. *Hijaak* allows you to resize bitmaps, specify output resolution, and even lets you change the brightness and contrast of an image.

Equally noteworthy are the vector to vector conversion options. With these, your converted file will preserve editable text instead of uneditable graphic outlines. *Hijaak* can translate the last saved view of a 3-D .DXF object to a two-dimensional format, and can use one of three different smoothness settings to convert a Bezier curve to a polyline composed of curve segments.

Like its predecessor, the new *Hijaak* can be operated from the DOS prompt, but most users should rely on the new mouse-driven, SAA-compliant (but still character-based) pull-down menus and dialog boxes. Still, even though the dialog boxes are intended to help navigate the options, *Hijaak* operates in rigid linear fashion. You must complete the information boxes in a prescribed order.

Hijaak's screen capture has been changed to take advantage of the memory management capabilities of the RPM (Resident Process Manager)—which requires only 5K of RAM in passive mode. You can pop up the RPM from within any DOS application to take a quick snapshot (stored in *Hijaak*'s proprietary .IGF format) or access the program and save to any supported format. Better yet, you can add your own applications to the RPM, giving you a very basic context switcher. A separate *Windows* Capture utility is provided.

Despite all of this praise, potential buyers should beware of *Hijaak* 2.0's numerous bugs. During testing, a too-large-to-convert .TIF file resulted in a fatal memory error message. The RPM had trouble coexisting with other TSRs, including a keyboard utility and a Logitech mouse driver.

Inset Systems claims that these problems will be fixed by the time this review is printed. They also intend to ship a free update to all registered users, because several were not implemented at ship time.

The conversion code is robust. Other than one or two little glitches—the attached .TIF header on an .EPS file mysteriously disappeared, and the aspect ratio of one vector conversion (from .CGM to .EPS) was distorted—the files were translated successfully. Though I would add viewing and printing functions, *Hijaak* remains the Swiss army knife of conversion programs. ■

List Price: *Hijaak*, Version 2.0, $199; upgrade from any previous version, $50. **Requires**: 640K RAM, hard disk, DOS 3.*x* or later, mouse recommended; can utilize EMS. Inset Systems Inc., 71 Commerce Dr., Brookfield, CT 06804; (800) 828-8088, (203) 740-2400.

CIRCLE 703 ON READER SERVICE CARD

WideAngle Controls Windows Clutter

HANDS ON
by Richard Hale Shaw

The more you use *Windows* or OS/2, the more windows you'll want open simultaneously. *WideAngle*, a $129 product for *Windows* and OS/2 allows you to have nine windows at once.

WideAngle lets your display become a viewport divided into nine different workspaces. Each workspace can have one or more applications. In wide-angle view you see nine workspaces. Number one appears in the bottom left corner, and the ninth in the upper right—the same arrangement as your numeric keypad, which makes locating a workspace intuitive. A graphical numeric keypad can move you to a workspace or workspaces can be given names in a list box.

Click on a numbered button and *WideAngle* switches you to the corresponding workspace. When you minimize the *WideAngle* window, the *WideAngle* icon is minimized, too. And regardless of which workspace you are in, or how many windows you have open, the *WideAngle* window or icon is at all times active.

Too many windows to track? *WideAngle* gives you nine separate viewpoints into the *Windows* desktop.

When you start *WideAngle*, your original Desktop—with currently open windows and icons—becomes the first workspace. *WideAngle* remains faithful to the viewport metaphor. If one of your windows extends off-screen, you'll find the remainder of it displayed when you switch to that adjoining workspace.

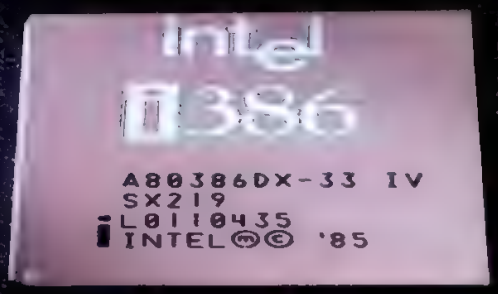
You can use *WideAngle*'s maximized window to move applications from one workspace to another. The window includes a displayed "map" of the workspaces, including a labeled outline of each open window. To move a window, drag its outline to the destination workspace. Applications can also be grouped and launched from within *WideAngle*.

Creating these tasks isn't exceedingly difficult, but things could certainly be more automatic. Right now, if you want an application to automatically run in a particular workspace, you can create a *WideAngle* Program Group with *Windows*' Program Manager. Even though it's awkward, the ability to create *WideAngle* tasks lets you organize a host of applications, start them in different workspaces, and do this repeatedly.

WideAngle provides the big picture; once you use the program, you'll wonder how you lived without it. ■

List Price: *WideAngle*, Version 1.0, $129. **Requires**: For *Windows* version: *Windows* 3.0, 640K RAM. For *Presentation Manager* version: OS/2 1.2, 4MB RAM, 80286 processor or higher. Inner Media, 60 Plain Rd., Hollis, NH 03049; (800) 962-2949 or (603) 465-3216.

CIRCLE 434 ON READER SERVICE CARD



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***Government Computer News*, "Arguably the fastest MS-DOS and OS/2 micro in the world."**

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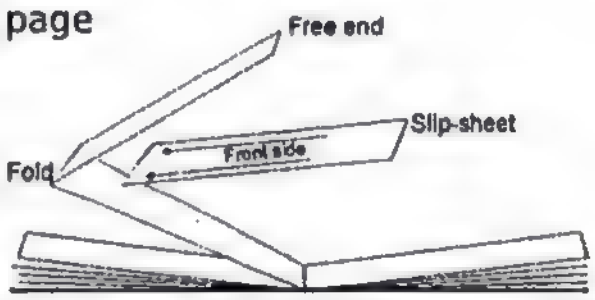

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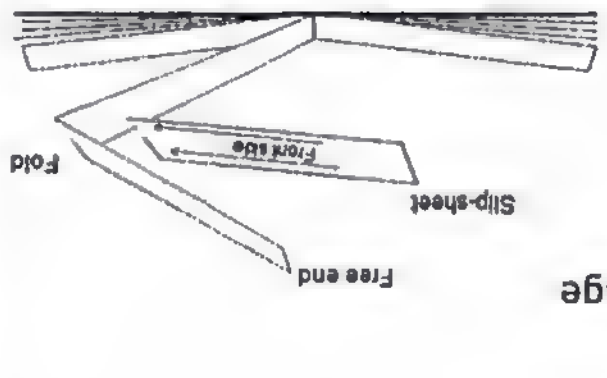

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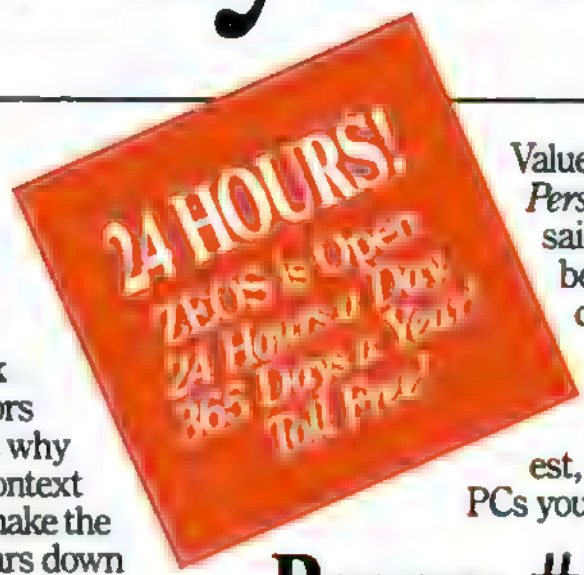

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Reason #2

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First Looks

PerForm Moves To Windows 3.0

HANDS ON
by Barry Brenesal

Delrina Technology has upgraded its GEM-based forms software program, *PerForm*, to run under *Windows* 3.0.

The new *PerForm Pro* provides excellent WYSIWYG form design tools, graphics import capabilities, and bar code support. Moreover, it can create linked forms that use file lookup and field checking. Fields can be linked to either *dBASE* or ASCII files.

The package is divided into two programs: *PerForm Designer* creates forms. *PerForm Filler* lets end users fill and print forms.

PerForm contains 12 click-on tools for creating forms including graphics primitives, bar code and line drawing icons, and several combs for creating multiple, evenly spaced partitions.

The tools can be customized. The Box Attributes menu, for instance, offers colors, gray, or patterned backgrounds. The graphics import menu adds EPS (Encapsulated PostScript) and *Windows* Metafile formats to an extensive list of supported file formats. One hundred predesigned forms are also included.

PerForm's relational capabilities have been overhauled. The program adds enough mathematical, logical, and financial functions to create a small but powerful language. With only minimal difficulty you can create conditional fields. The syntax is more straightforward than that used in Xerox's *FormBase*, and is easily learned.

Improved security features monitor access-privileges to the Designer module, individual forms, and even single fields. Encrypted electronic signatures are a welcome feature.

As of now, there's no support for *Windows* 3.0's DDE (Dynamic Data Exchange), which would be a natural in the forms processing arena. User-defined functions (UDFs), which allow the coding of *Windows*' dynamic link libraries are available, but not as useful as DDE. And while the forms creation process is straightforward, creating links and conditional fields can be harrowing.

PerForm Filler (available in December) is used exclusively to fill out *PerForm* forms, but at $195 a package, using a *Designer/Filler* solution in the workplace will be expensive. The *Filler* has a time-saving Fast Fill mode which replaces intensive graphics screens with plain vanilla data fields.

PerForm's help screens have been rewritten, but they're still short on information. The documentation is clear, thorough, and logically organized.

PerForm offers better design control than Xerox's *FormBase*, and more features than either Indigo Software's *JetForm* or Formworx's *Forms Publisher*. Delrina has announced a form-trace program, PC fax board drivers, and DDE as next on their upgrade agenda. ■

PerForm Pro's Designer module designs attractive forms with simple tools. The fill menu includes both data validation and conversion options to prepare fields for the Filler module.

List Price: *PerForm Pro* Designer & Filler, $495; $99 upgrade from *PerForm* 1.0 or 2.0.

Requires: 640K RAM (256K extended memory recommended); hard disk; *Windows* 3.0. Delrina Technology, 15495 Los Gatos Blvd. #8, Los Gatos, CA 95032; (800) 268-6082.

CIRCLE 433 ON READER SERVICE CARD

Goupil Golf: 386SX Portability with Built-in CD-ROM

HANDS ON
by Frederic Burns

Computer Peripherals' Goupil Golf 386 SX/CD, a French import, is probably the only portable on the market with a built-in CD-ROM drive. The stylish AC-only Golf is really a transportable desktop computer, weighing 19.4 pounds with a separate keyboard and detachable LCD. Measuring 4 by 13 by 14 inches (HWD), the $7,995 Golf carries a premium price tag. Its PC Labs Benchmarks scores place it on par with other 16-MHz 386SXs.

The unit comes with an Conner 40MB hard disk with a built-in Goupil controller, a VGA controller for the 10-inch backlit VGA LCD screen manufactured by Sharp Electronics, a 1.44MB floppy disk drive, and 100-nanosecond 640K RAM. A larger, 100MB hard drive is a $500 option. The machine supports up to 9MB of RAM, using SIMMs on a proprietary daughterboard; there are provisions for an 80387 math coprocessor and two 8-bit expansion slots. Computer Peripherals sells an external 1.2MB floppy disk drive unit for $349.50. Single parallel, serial and mouse ports round out the machine's standard I/O.

The monitor, which unfolds to rest atop the chassis and straddles the CD drive, provides good clarity. Below the display are six buttons that control video, gray scale, brightness and contrast. These fine-tune the screen, but they require some fiddling. The Golf also supports an external VGA monitor, but cannot drive the LCD and an external monitor simultaneously.

The most interesting feature of the Golf is its built-in 380 ms. Hitachi 3600 CD player. The player resides under a door on top of the unit. When the carrier is empty and the machine is booted up, the door cants upward and the carrier slides out. An audio jack and volume control are also part of the CD-ROM package.

Those users who depend on CD-ROMs as part of their business will appreciate Goupil's design, but the workmanship on the CD-ROM door and monitor hinges could be improved.

The 19.4 pound Goupil Golf features a built-in Hitachi CD.ROM.

Standard software includes DOS 4.01 and GW-BASIC. An evaluation copy of Computer Library was provided but is not sold by Goupil. The Golf is too bulky to be a true laptop, but the CD-ROM player makes it a unique machine. ■

List Price: Goupil Golf 386 SX/CD, with 1MB RAM, 40MB hard disk, internal CD-ROM drive, VGA LCD screen, DOS 4.01, carrying case, $7,995. Computer Peripherals Inc., 667 Rancho Conejo Blvd., Newbury Park CA 91320; (800) 854-7600.

CIRCLE 446 ON READER SERVICE CARD

Spontaneous Assembly—An Assembly Language Library

HANDS ON
by Ray Duncan

Base Two Development Inc. bills *Spontaneous Assembly* as "a complete assembly language library specifically designed for serious assembly language development."

It is, in fact, a *set* of libraries, one for each memory model (small, compact, large, etc.), that includes routines for screen and window management, dynamic memory management, critical error handling, string manipulation, data conversion, and extended-precision integer math, among others.

In short, *Spontaneous Assembly* puts most of the functionality of the Microsoft C or Turbo C++ runtime library at the fingertips of the assembly language software developer. The only obvious omission from the package is a battery of graphics functions for line drawing, arcs, bit-block transfers, and flood fills on the various IBM-compatible display adapters.

Spontaneous Assembly's 756-page manual is well written and organized, professionally produced, and blessed with extensive cross-references and a thorough index. The product also comes with complete source code on disk. Looking through a sampling of the files, I felt that the source code was satisfactorily structured and documented, with comprehensive procedure headers and comments.

This is certainly the most elaborate add-on package for assembly language programming that I have ever encountered. I cannot help wondering, however, if this is a solution to a problem that no longer exists or, at best, the solution to a problem that is very rapidly disappearing.

Most of the "serious" PC-based development these days is done in the high-level languages, with assembly language reserved for the occasional program bottleneck and "hotspot." Furthermore, those "serious" assembly language developers who must still persevere will have long since implemented nearly all of the capabilities found in *Spontaneous Assembly* on their own, with the possible solitary exception of the windowing functions.

Sadly enough, the one group that would really benefit from *Spontaneous Assembly*—neophyte assembly language programmers—is likely to be excluded by the package's price. *Spontaneous Assembly* would help these poor souls leapfrog many a perplexing implementation problem. It would set a good example with its modularity and carefully annotated source code.

But programmers who start out with a lone assembler are extremely cost-conscious, and *Spontaneous Assembly* costs nearly twice as much as Borland's *Turbo C++ Professional* package that includes a compiler, editor, assembler, profiler, and the *Turbo Debugger*! At a more accessible price, say for example, $95, *Spontaneous Assembly* would certainly be a "must have" for *MASM* or *TASM* beginners; at $395 however, it's nothing more than an interesting novelty. ■

List Price: *Spontaneous Assembly*, Version 2.0, $395. **Requires:** An assembler compatible with Microsoft *Macro Assembler*, Version 5.1, or Borland *TASM*, Version 1.0; DOS 2.0 or later. BaseTwo Development Inc., 11 E. 200 North, Orem, UT 84057; (800) 277-3625 or (801) 222-9500.

CIRCLE 432 ON READER SERVICE CARD

Coherent: Unix power for $99

HANDS ON
by Kaare Chr

No, even if you want to you can't wind the clock back to the late 1970s, but Unix lovers can do the next best thing—pick up a copy of Mark William's *Coherent* for $99.95.

Included in this time capsule are all of the utilities that you would have received in an AT&T Unix, Version 7, distribution circa 1978. The package includes a protected-mode multiuser multitasking operating system, over 150 utility programs, a C compiler, an assembler, software development tools, text formatting tools, system management tools, telecommunications utilities, and complete documentation in a very hefty, 1,000-page, perfect-bound book. Most of the Unix classics—grep, ed, sed, awk, lex, sh, emacs—are there as well. The only favorites that are missing are vi (which is a text editor) and Dave Korn's new shell.

Whether *Coherent*'s views on the Unix system match your own is a matter of taste. In the halcyon late 1970s, the Unix system was a relatively simple affair—lean and clean, and understandable to mere mortals. Since then, in an effort to make Unix the universal solution, countless features and versions have been grafted onto it by innumerable programmers, managers, committees, and boards of directors.

The result stands in stark contrast to the stated goals of Unix's inventors. *Coherent* remains true to Unix's roots and eschews local area networking, graphical user interfaces, menus, mice, and many of the other amenities that present-day DOS users and Unix users have come to expect of modern software.

Coherent's installation is painless, but only after the agony of freeing up a 7MB or larger partition on an ordinary MFM or RLL disk, on a classic AT architecture machine. Since they are products of the modern era, ESDI and SCSI disks, as well as IBM's Micro Channel architecture are not supported. Graphic display adapters are tolerated (used in text mode); mice are not supported. *Coherent* worked flawlessly, though, on my geriatric AT clone.

Coherent has a dual boot facility, so that you can choose to boot either DOS or *Coherent* during your startup procedures, but unfortunately you can't run DOS software from within the *Coherent* environment.

Mark Williams' president Robert Swartz explained that the intended audience for *Coherent* are people who want to learn about or try the Unix system, without the hefty price tag and steep learning curve of the latest Unix versions. Part of *Coherent*'s advantage in both simplicity and price stems from its origins as a privately developed "clone" product—therefore no AT&T requirements need be met and no per-copy royalty is paid to AT&T. This gives Mark Williams the freedom to set prices as well as compatibility targets.

But learning Unix from *Coherent* would be a bumpy road. You could certainly master traditional system administration, learn the utilities, and experiment with Unix software development. But you couldn't learn about networking or the increasingly important X Windows system. Nor could you realistically use *Coherent* to automate a small business.

Swartz promises that future versions of *Coherent* will support 32-bit operation on the 386, and will likely support tighter integration with DOS, some form of window manager, and local area networking. When that occurs, *Coherent* will be much more like modern Unix systems and, like modern Unix systems, it will have strayed far from its roots. ■

List Price: *Coherent*, Version 3.0, $99.95. **Requires:** A free 7MB or larger hard disk partition, 640K RAM, high-density disk drive, MFM or RLL controller. Mark Williams Co., 601 N. Skokie Hwy., Lake Bluff, IL 60044-9916; (708) 291-6700.

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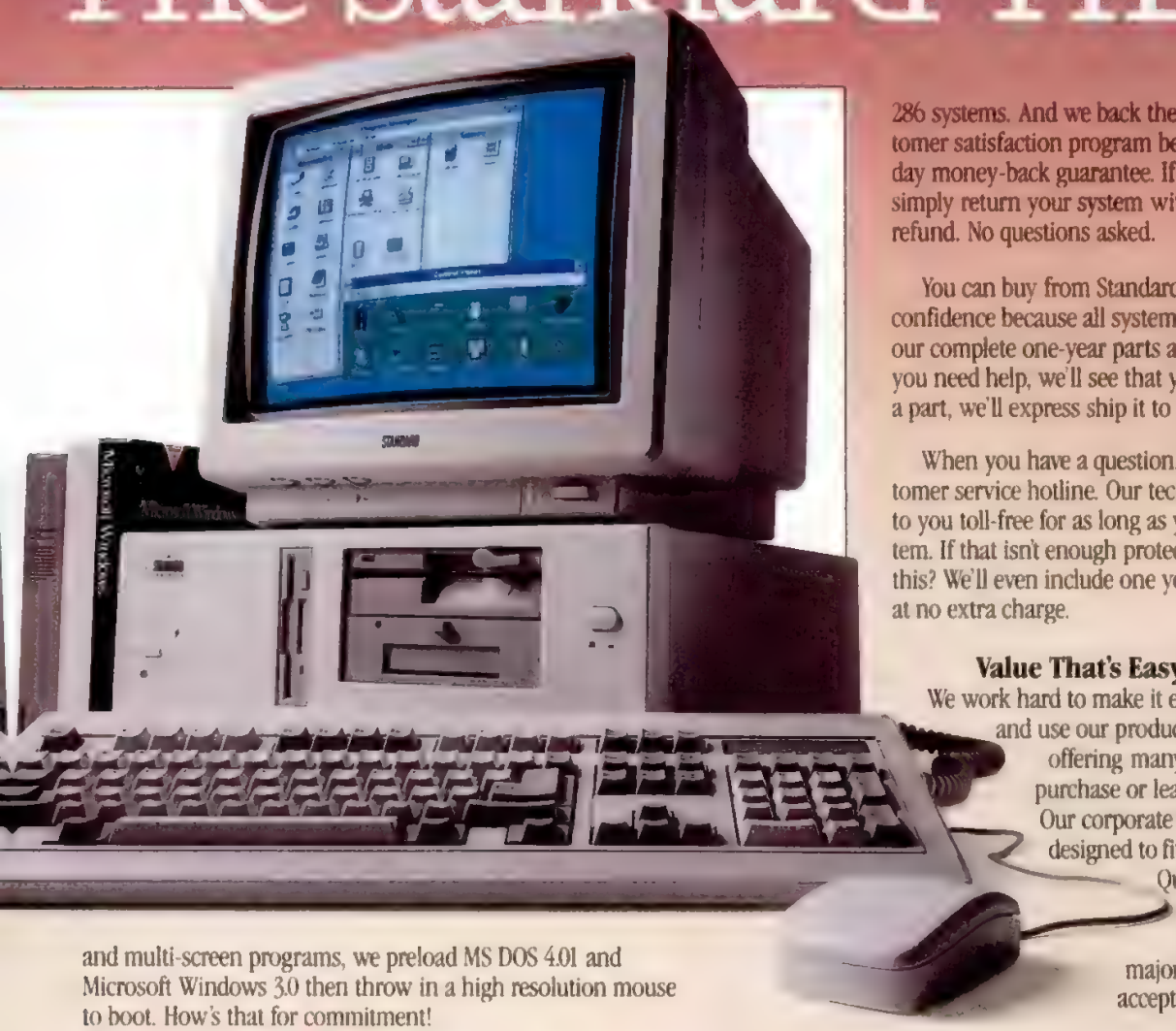

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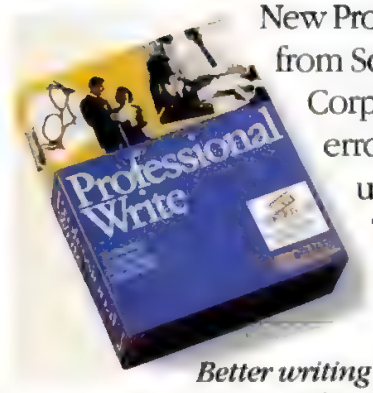
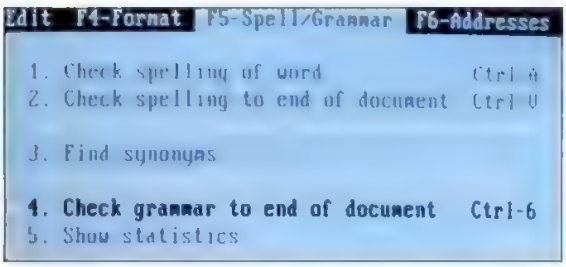


New Professional Write® 2.2 from Software Publishing Corporation detects errors in grammar, style, usage and punctuation. Then recommends a way to correct them.

Better writing for busy executives.

This new version also supports many more printers, including HP® LaserJet® III, LaserJet IIP, and DeskJet® Plus. And offers a new line of HP font support, as well as the 25 in One!™ III cartridge from Pacific Data Products.



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by Rink Murray

New & Improved

News of Announced Products and Upgrades

Road Warrior

NEW

Computer Products Plus has introduced a portable, battery-powered thermal printer. Measuring 1.12 by 11.5 by 6.75 inches (HWD), the Road Warrior WsP-200 weighs 3.6 pounds when used with its 90-minute rechargeable nickel cadmium battery. The Road Warrior WsP-200 prints text and graphics at speeds up to 33 characters per second (56 characters per second in condensed mode), and supports four emulations: standard dot matrix, Epson LQ-800/1000, LQ-2500, and LQ-1500. The WsP-200 can also run on AC power or, in case of emergency, with standard C batteries.

The $349.95 Road Warrior WsP-200 prints at 33 chars per second and fits inside a briefcase.

List Price: The Road Warrior WsP-200, $349.95. Computer Products Plus Inc., 16351 Gothard St., Huntington Beach, CA 92647; (800) 274-4277 or (714) 847-1799.

CIRCLE 436 ON READER SERVICE CARD

Communications Under Windows 3.0

NEW

Digital Communications Associates has begun *IRMA WorkStation for Windows*, a software communications package operating under *Windows 3.0*. *IRMA* handles communications between PCs and mainframe computers or minicomputers. Also provided is the company's new Standard *IRMA* Scripting Language (SISL), a general-purpose communications development tool both for the asynchronous and for the synchronous environments. For routine tasks, the QuickScript feature records and saves keystroke sequences as scripts; users can then invoke the commands with a mouse. Since SISL supports *Windows* 3.0's Dynamic Data Exchange (DDE), users can access mainframe applications from within their current applications. *IRMA WorkStation for Windows* takes advantage of several connectivity schemes including: direct connection over coaxial cable in Control Unit Terminal (CUT) and Distributed Function Terminal (DFT) modes; Token-Ring media; and Synchronous Data-Link Control (SDLC) for remote connections over telephone lines. *IRMA* also supports asynchronous connections to mini-computers and bulletin boards and allows users to emulate ANSI/ASCII terminals. The package also supports node type 2.1 transport protocols, enabling users to conduct multiple concurrent Advanced Program-to-Program Communications (APPC) conversations.

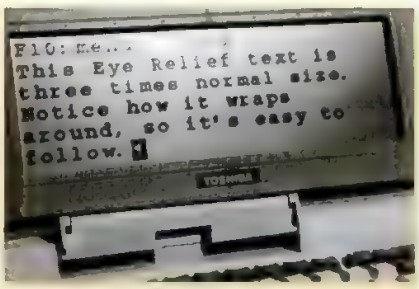
List Price: *IRMA WorkStation for Windows*, $495. **Requires:** 2MB RAM, DOS 3.3 or later. Digital Communications Associates Inc. 1000 Alderman Dr., Alpharetta, GA 30202-4199; (404) 442-4000.

CIRCLE 437 ON READER SERVICE CARD

HOT PROSPECT

EYE RELIEF UTILITY MAGNIFIES LAPTOPS' ON-SCREEN TEXT

SkiSoft Publishing Corp.'s *Eye Relief for Laptops* is an ASCII word processor that makes any laptop computer screen easy on the eyes. *Eye Relief* allows users to work with normal-sized text, or it can magnify the text two, three, or four times. The user controls vertical and horizontal spacing, as well as the cursor blink rate. *Eye Relief* requires 90K RAM, and touts pull-down menus with basic word processing features such as online help, cut and paste, copy, margins, headers, and footers. SkiSoft's cursor magnification utility makes it hard to lose your place. With *No-Squint II*, users can increase the size of the cursor, make it bold, and control the blink rate. *No-Squint II* uses only 5K RAM, and it is compatible with most text-based software applications.



SkiSoft's *Eye Relief for Laptops* displays text here at three times its normal size.

List Price: *Eye Relief for Laptops*, $129.95. **Requires:** 90K RAM, DOS 2.11 or later. **List Price:** *No-Squint II*, $49.95. **Requires:** 5K RAM, DOS 2.11 or later. SkiSoft Publishing Corp., 1644 Massachusetts Ave., #79, Lexington, MA 02173; (617) 863-1876.

CIRCLE 438 ON READER SERVICE CARD

Look Who's Talking

NEW

The Caller ID+Plus from **Rochell Communications** is a business contact management system which displays database information on incoming callers. The Caller ID+Plus is a hardware/software package that takes advantage of the AT&T's Caller ID service to identify incoming calls. If the calling number information has been linked with your database, the program automatically shows you the name and company of the person calling, as well as a historical log of all calls to and from the caller. The adjacent note pad holds up to 4,000 characters per call and each ID can handle up to 65,000 notes. Users can implement string searches to locate any caller ID information or other information in the pad. If the number is not in your database, you can bring up the information manually. The Caller ID+Plus records time, date, and duration of every call. It also features a log of unanswered calls so you can return calls at your convenience. The software is memory-resident and imports/exports files to and from popular database programs such as *dBASE III*. The hardware cable plugs directly into a standard 25-pin serial port, and requires no external power source.

List Price: Caller ID+Plus, $185. Rochelle Communications Inc., 8716 N. Mopac, #200, Austin, TX 78759; (512) 794-0088.

CIRCLE 439 ON READER SERVICE CARD

CONTINUES ON PAGE 56

Wyse Announces High- And Low-End PCs

NEW

Wyse Technology introduces the Decision 486/33E, a 33-MHz 486 EISA tower PC. The 486/33E features a 64-bit asynchronous system bus which is independent of processor speed, and therefore permits upgrades to faster microprocessors like Intel's promised 50-MHz 486 chip. The 486/33E also features 2MB RAM expandable to 192MB, a 128K processor cache, an optional 300 or 660MB ESDI hard disk system, and a 325-watt power supply. Expansion includes nine 32-bit EISA slots, and four 64-bit slots.

On the lower end, Wyse has announced the Decision 386SX/16S, a 16-MHz 386SX available in diskless, floppy, and hard disk versions. The low-profile 386SX/16S measures 3 by 14.6 by 15.7 inches, is upgradable to 8MB RAM on the motherboard and features Super VGA graphics circuitry. Expansion includes two full-sized 16-bit slots.

List Price: Decision 486/33E with 2MB RAM, 300MB hard disk, $11,999; Decision 386SX/16S with 1MB RAM, high-density 3.5-inch floppy drive, 40MB hard disk, $2,299. Wyse Technology, 3471 N. First St., San Jose, CA 95134; (408) 473-1200.

CIRCLE 439 ON READER SERVICE CARD

The UnMouse Is Unveiled for PCs

NEW

MicroTouch Systems has begun shipping the PC UnMouse, an alternate input device that looks like a miniature digitizing tablet. Measuring 3 by 4.5 inches, the UnMouse combines fast cursor control, enhanced keypad functions, and stylus-based graphics, and promises a resolution of 1,000 by 1,000 points. To move the cursor you simply slide your finger across the pad; to click the "mouse button" you just press lightly on the tablet. The selectable scaling feature allows ultra-fine control for when you want your finger to move slowly. Using the UnMouse stylus, users can draw figures, annotate documents, or enter signatures. The UnMouse can also be used as a function keypad with labeled templates. The keypad has 16 keys, 12 of which correspond with the PC's function keys; the other four act as alternate Shift, Alt, Ctrl, and Enter keys. MicroTouch provides templates for several popular applications including *WordPerfect* and *Lotus 1-2-3*. Blank templates are also included.

List Price: UnMouse $235. MicroTouch Systems Inc., 55 Jonspin Rd., Wilmington, MA 01887; (800) UNMOUSE or (508) 694-9900.

CIRCLE 440 ON READER SERVICE CARD

The UnMouse coordinates match the screen, so users can draw and point more accurately than with a mouse.

IMPROVED

PowerSave—Dakota Microsystems' internal UPS on a card now supports extended and expanded memory as well as memory stored in disk caching. With its updated software the PowerSave 500 will back up and restore systems which use EMS 3.2, EMS 4.0 or EEMS. Other enhancements include a user interrupt feature that allows PowerSave 500 to call a user-written TSR software routine when power loss is detected, compatibility with switchable display adapters, MCGA compatibility, and an improved install/setup program. PowerSave also allows users to shut down their PC without exiting applications, and then return to the same position just by turning the computer back on. PowerSave consists of a full-length 8- or 16-bit card and nickel cadmium batteries, an internal power cable, and an on-board processor. PowerSave retails for $399.95 from Dakota Microsystems at 2145 The Alameda, #101, San Jose, CA 95126-1141; (415) 967-2302.

***Superbase 2*, Version 1.2**—Precision Software has announced a *Windows* 3.0 version of its integrated forms design, application development, relational database management software. Also in Version 1.2 is a new Form Painter which allows users to customize input screens and to create and print presentation-quality output forms from any *Windows*-compatible printer. New runtime capabilities permit users to run applications written using *Superbase 4*'s DML command language, including forms, command pushbuttons and other features. The program also includes DDE support, and support for additional graphics file types such as encapsulated PostScript (.EPS), device-independent bitmap (.BMP), and CCITT Group III and IV fax file formats with up to 256 colors. *Superbase 2*, Version 1.2 retails for $345; registered users can upgrade for $50 from Precision Software Inc., which is located in Irving, Tex. at (214) 929-4888.

***Turbo EMS*, Version 6.0**. The $99.95 memory manager is now compatible with *Windows* 3.0, through the use of Microsoft's new virtual device driver (VxD). The VxD lets 386 users load software into high memory, and then simultaneously run *Windows* 3.0 in 386 virtual mode. *Turbo EMS* 6.0 also offers users automatic installation, mapping of multiple blocks of DOS high memory, best-fit loading of TSRs, and compatibility with Microsoft's HIMEM.SYS. Registered owners can upgrade for $25. Contact Merrill & Bryan in San Diego, Calif. at (619) 689-8611.

***P.D.Q.*, Version 2.10**—Crescent Software promises that *P.D.Q.*, Version 2.10, enables QuickBASIC programmers to create applications that are smaller and faster than either C or Pascal, while taking advantage of the language features of BASIC. Version 2.10 replaces the default linking library supplied by Microsoft, and also lets BASIC programmers easily create TSR (terminate and stay resident) utilities and interrupt handlers. Programs created by *P.D.Q.* can run under Quarterdeck's *DESQview* and *Microsoft Windows*. Notable improvements in Version 2.10 include greater compatibility with QuickBASIC, more BASIC statements and functions, and the elimination of nearly all syntax differences. A Quick Library simplifies program development within the QuickBASIC and QBX development environments. *P.D.Q.*

CONTINUES ON PAGE 58

Internal Backup Power

NEW

Powercard's eponymous internal UPS is now shipping. When power outages occur, Powercard IPS saves the entire computer environment to disk, including anything in extended or expanded memory, and then restores it when the power returns. This "freezing" of an application even works if you turn off your computer, allowing you to resume exactly where you left off. The Powercard IPS features a 180-watt output capacity, and can freeze up to 16MB of memory in just a few seconds. Since the Powercard has its own on-

CONTINUES ON PAGE 58

Make Powerful Connections with Borland's New Paradox

By any standard, Paradox® is the most powerful database. That's why it's been rated #1 by every leading computer publication, and why hundreds of thousands of users worldwide have switched to Paradox.

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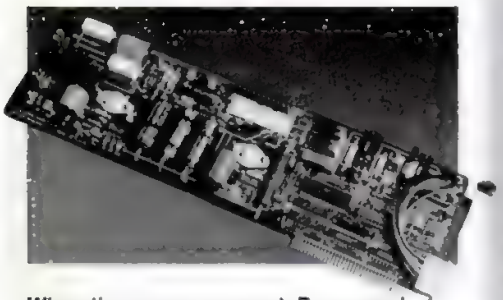
Code: ME01

*Paradox SQL Link ($495 suggested retail) is an add-on product for Paradox 3.5 and is required to make the connection with SQL servers. **Microsoft, IBM, Oracle and DEC Rdb/VMS servers supported now. †Offer also good for owners of any version of RBase or DataEase. Proof of ownership (a page from the manual) is required. Satisfaction guaranteed or your money back. Mail orders to: Borland International Inc., P.O. Box 660001, Scotts Valley, CA 95067-0001. Add $9.00 for shipping and handling. Residents in CA, CT, GA, IL, MA, MI, NY, OH, PA, TX, VA and WA, please add appropriate sales tax. For orders outside the U.S., call (408) 438-5300. Copyright ©1990 Borland. All rights reserved. BI 1369C



When the power goes out, Powercard takes a snapshot of your system, and returns you there when the power returns.

board RAM and since it's BIOS driven, it doesn't require device drivers, TSRs or DOS resources.
List Price: Powercard IPS, $299. Powercard, 12231 SW 129 Ct., Miami, FL 33186; (305) 251-5855.

CIRCLE 441 ON READER SERVICE CARD

Color Scanning From UMAX

NEW

Promising four-minute color output, **UMAX Technologies** announces the UC300, a 24-bit scanner that recognizes as many as 16.8 million colors at resolutions up to 300 dots per inch. Weighing 18 pounds and measuring 5 by 21 by 13.4 (HWD), the UC300 is a three-pass scanner that features Astral's *Picture Publisher Plus* and a SCSI host adapter for the IBM AT or Micro Channel architectures. The UC300 also supports gray scale and line art modes.
List Price: UC300, $2,495. UMAX Technologies Inc., 2352 Walsh Ave., Santa Clara, CA 95051; (408) 982-0771.

CIRCLE 442 ON READER SERVICE CARD

Printer Tallies 800 Lines Per Minute

NEW

For PC networks which have high-volume paper output, **Mannesmann Tally** introduces an 800 line-per-minute line matrix printer for $6,999. Weighing 77 pounds and measuring 44 by 31.35 by 22 inches (HWD), the MT661 is a straight paper path and tractor set printer that features a View button for dynamic forms adjustment and alignment, six resident fonts, 21 language character sets plus 4 OCR sets, 15 character pitches, 10 character heights, and 8 character styles. The MT661 can print any character on the page in any font, style, width, or height, in any combination. The MT661 also features a quiet mode and a shared parallel/serial architecture that allows support for two host computers.
List Price: MT661, $6,999. Mannesmann Tally Corp., 8301 S. 180th St., Kent, WA 98032; (800) 843-1347 or (206) 251-5524.

CIRCLE 443 ON READER SERVICE CARD

Writable Cartridges

NEW

FormGen Corp. announces a product that allows users to store forms on a laser printer Writable Cartridge. With Writable Cartridges users can store forms, fonts, logos, and boiler plate information directly on a nonvolatile writable and readable laser cartridge. This scheme eliminates the need for preprinted forms, and the extra printer memory required to print some forms. Forms stored on the Writable Cartridge can be updated at any time with any PC application. For security-conscious users, the cartridges support password protection for the cartridge and for individual forms. The Writable Cartridge ships standard with 128K RAM, and currently only with works with Maxx/8 laser printers from JPS Microsystems Inc. Higher capacity cartridges and support for additional printers are forthcoming.

CONTINUES ON PAGE 60

IMPROVED

CONTINUED FROM PAGE 56

now supports dynamic arrays, and improved debugging increases runtime error checking. String handling performance is improved, and ON ERROR, OPEN FOR RANDOM and APPEND, READ and DATA, and *Microsoft BASIC 7.x* Professional Development System are now all supported. An optional communications library is available at extra cost of $49. *P.D.Q.*, Version 2.10, is available for $129 with upgrades available for $39 from Crescent Software in West Redding, Conn. at (203) 438-5300.

***FileTalk*, Version 2.0**—Mountain Computer Solutions' graphical data management software system now allows network administrators to protect and manage valuable corporate data in a distributed manner. Version 2.0 will provide network managers the flexibility to create a customized environment that is tailored to their individual requirements. Going beyond previous versions' abilities to back up data, Version 2.0 helps users track, store, and distribute data wherever and whenever it's needed. Other features include flexible locking structures, and a peer-to-peer communications support across DOS, OS/2, Macintosh, *NetWare 286* and *386*, and *Microsoft LAN Manager* 2.0 systems. *FileTalk*, Version 2.0, retails for $229 for five users and $695 for 20 users for upgrades contact Mountain Computer Solutions in Campbell, Calif. at (800) 458-0300 or (408) 379-4300.

pcANYWHERE IV/LAN—DMA announces that its communications program supports remote computing across, into, and out of a PC network. Operating in real-time network speed, *IV/LAN* lets one workstation control another workstation from anywhere on the network, or from another network, or control a standalone PC in a remote location at speeds up to 115,200 bps. Other features the program include are the ability to create serial communication gateways to NetBIOS or IPX LAN communications, VT220 emulation, XMODEM file transfer, bidirectional high-speed file transfers in the foreground or background, and automated unattended file transfer sessions. *pcANYWHERE IV/LAN* retails for $495 from DMA in Huntington, N.Y. at (516) 462-0440.

***Drawbase-386*, Release 107**—CADworks' scalable 386 CAD drawing and database solution now includes support of Phar Lap 386/DOS Extender. By breaking the DOS 640K limit, increased memory can be used for application programs, memory-resident drivers, and network drivers. Operating in a network environment Release 107 allows users to: control and distribute layer templates, CAD parameters, as well as report and attribute definitions; share peripherals; and use password security. *Drawbase-386* also contains the Application Programming Interface (API) that allows users to develop, load, and execute application programs. Retail pricing for *Drawbase-386* starts at $2,195. For upgrade information contact CADworks Inc., located in Cambridge, Mass., at (617) 868-6003.

pc/MRP3—Software Art's low-cost accounting package has announced support for *dBASE III+* files. Other features include larger address fields, user-definable boiler plate for forms, a retail order entry screen, sales commission reports, an auto accounting option, a Try Again option on entry errors, and an improved record-locking scheme. pc/MRP3 retails for $149 for the single-user version, and for $695 for the multiuser version, with upgrades available for $35. Contact Software Arts in Santa Clara, Calif. at (408) 248-6445.

If You Think It Takes This Many Steps To Create A Database, Try Q&A.

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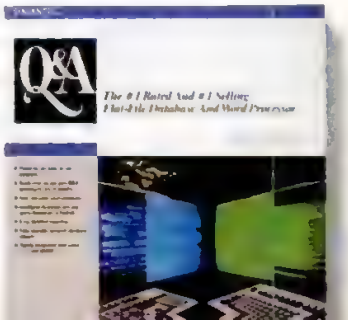

Symantec Corporation, 10201 Torre Avenue, Cupertino, CA 95014. 408/253-9600.

*Q&A awards: #1 Corporate Satisfaction PC Week 1/89; Software Digest #1 Network File Manager 1/90 and #1 File Manager 2/88; PC World's World Class 9/88 and 9/89; InfoWorld 9.3 rating 5/88; PC Magazine Editor's Choice '87 and '88, and Technical Excellence 1988. Q&A is a trademark of Symantec Corporation.

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CIRCLE 344 ON READER SERVICE CARD

List Price: Writable Cartridge with 128K, $295. **Requires:** Maxx/8 laser printer. FormGen Corp., 13 Holland Dr., Bolton, Ontario, Canada, L7E 1G4; (800) 263-2390 or (416) 857-4141.

CIRCLE 444 ON READER SERVICE CARD

Mountain Introduces 1.3 GB DAT Storage

NEW

Mountain Computer's high-end storage solutions now offer more than a gigabyte for PC workstations and network applications. The FileSafe 1200 Series is based on Digital Audio Tape (DAT) technology, and promises an average access time of 20 seconds for a 1.3GB, 4-mm. cassette. The FileSafe 1200d uses two drives daisy-chained together for 2.6GB, and additional 1200d's can be added to increase storage capacity up to a total of 5.2GB.

Meeting the needs of users with an installed base of 0.25-inch data cartridge systems, Mountain offers the FileSafe 7500 Series. The 7500 provides a capacity of 525MB on a single cartridge, but is available in a dual-drive configuration offering more than a gigabyte of storage capacity for unattended backup operations. Both series feature an LED that uses the SCSI bus to recognize and prompt the user when the drive is searching or writing to the tape. All of the new FileSafe drives ship with *FileTalk* (see Improved), Mountain's data management software application for networks.
List Price: FileSafe 1200, half-height internal unit, $5,495; 1200 full-height external unit, $5,995; 1200d, $9,995; 7500, $3,995; 7500d, $5,495. Mountain Computer Inc., 240 Hacienda Ave., Campbell, CA 95008-6687; (408) 379-4300.

CIRCLE 445 ON READER SERVICE CARD

SCSI Extender

NEW

Applied Concepts announces a peripheral that enables users to extend the working distance of any SCSI bus interface an additional 19 feet. The ACI 1074 SCSI Plus Bus Repeater is a SCSI bus extender that connects directly to SCSI interface adapters and peripherals. The SCSI Plus Bus Repeater transfers data at rates up to 5MB per second and adheres to ANSI X3.131 standard.
List Price: ACI 1074 SCSI Bus Repeater, $350. Applied Concepts Inc., 5350-H Eastgate Mall, San Diego, CA 92121; (619) 453-0090.

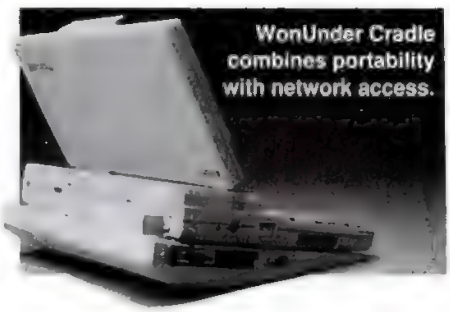
CIRCLE 447 ON READER SERVICE CARD

Chassis Cradle Gives Toshiba One Under

NEW

For users who want to combine notebook portability and network functionality, **Connect Computer** is now shipping a portable expansion unit for Toshiba notebook computers. Accommodating either an 8- or 16-bit expansion card, the WonUnder Cradle hooks into the expansion slot and attaches to the base of any Toshiba T1000SE, T1000XE, or T1200XE. Weighing 4.5 pounds, the WonUnder measures 1.5 by 13.75 by 9.62 inches (HWD) and accommodates a full-length card; it also has its own AC power supply that can even drive the laptop.
List Price: WonUnder Cradle, $399; car adapter, $89. **Requires:** Toshiba T1000SE, T1000XE, or T1200XE notebook computer. Connect Computer Co., 9855 W. 78th St., #270, Eden Prairie, MN 55344; (612) 944-0181.

CIRCLE 448 ON READER SERVICE CARD



WonUnder Cradle combines portability with network access.

ByteLink Adds Peripheral-Sharing Devices

NEW

Protec Microsystems announces the ByteLink Plus line of intelligent peripheral-sharing devices. Each ByteLink Plus features 1MB RAM upgradable to 4MB, and 24 ports divided into four 6-port units. This configuration lets users mix and match varying numbers of parallel and serial ports according to their needs. (Either 24 serial, 24 parallel, 6 serial/18 parallel, 12 serial/12 parallel, or 18 serial/6 parallel.) Each group of 6 ports boasts its own dedicated CPU. Each parallel port can be programmed as input or output, and every serial port operates at speeds up to 38,400 bits per second and can be set for output only or bidirectional. Other features include user-definable pop-up menus, e-mail, a broadcast feature that sends the same job to multiple ports, and built-in diagnostics.
List Price: ByteLink Plus, $1,995. Protec Microsystems Inc., 557 Lepine Ave., Dorval, Quebec, Canada H9P 2R2; (514) 630-5832.

CIRCLE 449 ON READER SERVICE CARD

Modems

NEW

Sharp 9624 Series

Sharp has announced its first modems. Respectively, the 9624 and 9624e are internal and external full-duplex modems. Both are 9,600/2,400-bps devices that feature MNP Level 5 data compression and a two-year warranty.
List Price: 9624, $299; 9624e, $399. Sharp Digital Information Products Inc., 16841 Armstrong Ave., Irvine, CA 92714-4979; (714) 261-6224.

CIRCLE 450 ON READER SERVICE CARD

MaxFax 9624LT-T

Macronix introduces the MaxFax 9624LT-T, a Group III-compatible, send-only, 2,400-bps fax/modem card for Toshiba laptop and notebook computers. The 9624LT-T has an on-board microprocessor, so it doesn't degrade laptop performance. It also features an auto-direct function that determines whether the incoming call is for the fax or modem.
List Price: MaxFax 9624LT-T, $599. Macronix Inc., 1348 Ridder Park Dr., San Jose, CA 95131; (408) 453-8088.

CIRCLE 700 ON READER SERVICE CARD

Desktop Type House Offers 1,000 Fonts

NEW

Positioned somewhere between desktop publishing programs and professional type houses, **The Black Point Group**'s *TX-1000* typesetting and page layout program offers 1,000 fonts for $169. Users lay out their pages, select the typefaces and sizes, and then transmit the data via *TX-1000*'s communications software across an 800-number to Black Point headquarters. Black Point runs the data through its Compugraphic Typesetter (at a cost of $9.50 per page), and within 24 hours the company returns the camera-ready 1,500-dpi professional quality type. *TX-1000* supports each font (plus over 1,300 dingbats and symbols) in sizes from 5 to 72 points and rules and rectangles from hairline size to 72 points.
List Price: TX-1000, $169. **Requires:** 512K RAM, two floppy drives or one hard disk drive, DOS 2.1 or later. The Black Point Group, 340 Townsend St., #420, San Francisco, CA 94107; (415) 243-9311.

CIRCLE 701 ON READER SERVICE CARD

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It's easy to get lost searching for the right computer system in today's cluttered, chaotic market. We have earned an excellent reputation for providing the right hardware at the lowest price. Right now, our TC Systems and peripherals are on line, solving problems and meeting the needs of new, innovative challenges being confronted by some of the world's most important and demanding clients including Exxon, Freeport McMoran, 3M, Honeywell, AT&T, McDonnell Douglas, Johnson & Johnson, Penn State University, Oxford University, Hewlett Packard, and Boeing just to name a few.

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- Intel Processor
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PC MAGAZINE

PC Magazine says about our TC 386 SX:

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"The processor and memory scores compare excellently with those of other 386SX machines." From PC Magazine, Volume 9, #14 pages 175 & 176

TC 386 SX

16MHz SX

45Meg/28ms	$1559
84Meg/20ms	$1759
125Meg/20ms	$1859

20MHz SX

45Meg/28ms	$1699
84Meg/20ms	$1899
125Meg/20ms	$1999

TC 386 & TC 486

25MHz TC 386

45Meg/28ms	$1959
84Meg/20ms	$2159
125Meg/20ms	$2259

Add $250 for 64k Cache

33MHz TC 386 w/64k Cache

45Meg/28ms	$2399
84Meg/20ms	$2599
125Meg/20ms	$2699

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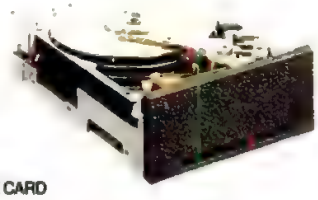

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The #1 laptop brand in America* brings you the SlimsPort™ 286 laptop PC—for uncompromising 286 power and VGA graphics.

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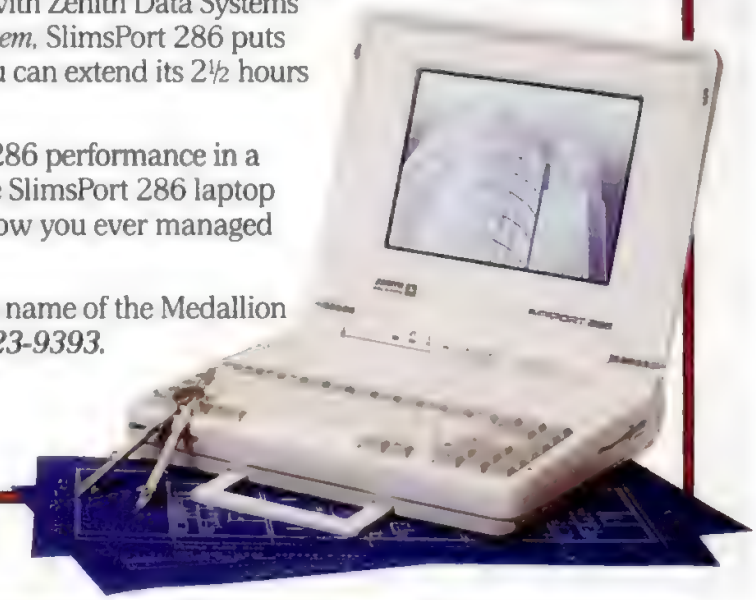
It offers VGA video and a backlit, fluorescent black-on-white, full-size LCD display that's ideal for graphical user interface computing. So you'll always have a bright, clear view of the big picture. And with Zenith Data Systems' *Intelligent Power Management™ System*, SlimsPort 286 puts power usage in your control so you can extend its 2½ hours of battery life even longer.

If your job demands full-size 286 performance in a downsized laptop, carry away the SlimsPort 286 laptop PC. Once you do, you'll wonder how you ever managed without it.

For more information and the name of the Medallion Reseller nearest you, call *1-800-523-9393.*

ZENITH data systems

Groupe Bull



*Source: 1990 Dataquest estimate for U.S. battery-powered laptops. Graphics simulate Microsoft® *Windows™ version 3.0*, a product of Microsoft Corporation. *Intelligent Power Management* is a trademark of Zenith Data Systems Corporation.

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CIRCLE 732 ON READER SERVICE CARD

edited by
Matthew J. Ross

Read Only

Reviews of the Latest Books for the PC User

Improving PC Skills

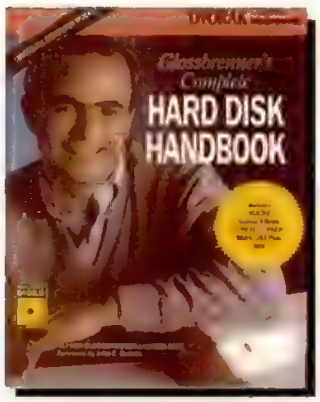
■ *Glossbrenner's Complete Hard Disk Handbook*
by Alfred Glossbrenner and Nick Anis
Osborne/McGraw-Hill, $39.95

A little understanding of hard disk technology and the right software tools can lead you to major performance gains. That's the premise behind an impressive book, *Glossbrenner's Complete Hard Disk Handbook*, which offers over 700 pages of comprehensive information on purchasing, installing, and maintaining a hard disk, plus two disks full of utilities.

If you are about to upgrade your floppy-based PC or add a second hard disk to your present system, your first question will probably be, how big? The authors offer some concrete advice: "Buy the biggest, fastest hard disk system your computer can handle and your pocketbook can afford." They go on to explain other important purchase decisions such as controller cards, RLL versus MFM encoding, and the merits of ST-506/412, ESDI, and SCSI interfaces.

You may consider the prospect of installing and formatting a hard disk daunting, but here you will find detailed yet easy-to-follow instructions. Included is a program called *The Hard Disk Tutor*, written by coauthor Anis, which familiarizes you with crucial commands such as FORMAT and FDISK before you have to run them. It also takes you on a dry run through several commercial programs including *The Norton Utilities*, *SpinRite*, and *PC Tools Deluxe*.

Two chapters are devoted to navigating your hard disk, and the Five Universal Hard Disk Tasks: finding where you are, moving someplace else, looking around, actually doing something, and directory "tree" work. The finer points of the DOS command line are explained, followed by an overview of DOS shells, menus, and front ends.



Thorough coverage and organization make *Glossbrenner's* an excellent reference book.

The book explains various ways you can "tweak" your system, removing the mystery from such topics as caches, file fragmentation, and optimum interleave. And the authors balance a solid explanation of the technology with a description of various software solutions.

A good portion of the book is devoted to smart computing habits: preventing catastrophes by keeping your hard disk in shape, protection from unwanted intrusions, recovering lost files, and an in-depth discussion of various backup methods.

The accompanying 5.25-inch disks offer nearly 40 indispensable hard disk utilities. The programs complement the book by allowing you to try many of the tactics as they are discussed. Unfortunately, the many utilities are overwhelming to organize and use. A powerful program called *MarxMenu* pulls the utilities together into a single hierarchical menu, but the program must be ordered separately.

The book's language is clear and concise, with easily understood technical descriptions. Numerous "guidepoints" amplify relevant topics for power users and beginners alike. The authors include a directory of manufacturers' addresses and phone numbers, and a thorough index makes this a book you'll want to keep close at hand for ready reference.

—Thomas W. Giebel

Glossbrenner's Complete Hard Disk Handbook
Osborne/McGraw-Hill, Berkeley, CA 94710; (800) 227-0900.
ISBN: 0-07-881604-1

CIRCLE 396 ON READER SERVICE CARD

■ *The Secret Guide to Computers*
by Russ Walter
Russ Walter, $15.

Russ Walter is both the author and publisher of his secret 607-page guide, and he's willing to discount its $15 list price as much as 60 percent, for good reason. He wants to help everyone learn how to use computers. Walter is serious: he publishes his home phone number and encourages everyone to call for free help with computer questions.

Walter may sound nutty, but fortunately the end result of all this is *The Secret Guide to Computers*, now in its 14th edition. *The Secret Guide* is a tutorial that explains the computer industry, hardware, languages, operating systems, and applications, in a knowledgeable and amusing fashion.

The Secret Guide has five rough sections. "Starting—how to buy a great system and boot up" includes Walter's unbiased view of the relative successes and failures of various companies, replete with inside gossip and jokes. This section explains how components work and features an 18-page section devoted to using DOS commands. Walter also delves into price, support, and shipping policies.

Walter then examines "How to choose and use the best software." He uses BASIC as a way to learn about computers in a detailed 116-page section, and follows with "How to write programs that go beyond BASIC."

The last section of the book consists of several indices including a vendor phone book plus tips on how to get jobs in the computing industry.

What are *The Secret Guide*'s shortcomings? Well, if you think computers should only be taken seriously, you might not like this book too much. The book falls short of its claim to make you a computer "expert," although if you work your way through it you'll certainly know more than many who make their living with PCs. Whether novice or expert, you'll learn from *The Secret Guide to Computers* and have a good time doing so. No other book about computers is a better value.**—Bruce Brown** ■

The Secret Guide to Computers
Russ Walter, Somerville, MA 02144; (617) 666-2666.
ISBN: 0-939151-14-6

CIRCLE 397 ON READER SERVICE CARD

Cut your utility bills nearly in half.

Now the best value in award-winning utilities gives you even more reason to buy. When you purchase PC Tools between now and December 31, you can get FREE* a full-featured copy of Qualitas' 386MAX 5.0 and begin to take full advantage of your 80386 PC's advanced memory-management capabilities.

This special edition of 386MAX allows your 386- or 486-based computer to load popular PC Tools functions (like the DOS Shell and Desktop Manager) into "high" memory above 640K, freeing up conventional RAM for other, large applications. Not only is 386MAX ideal for PC Tools owners, it's a comprehensive memory-management solution that features EMS 4.0 emulation, automatic system optimization and extensive diagnostics.

Consider it our way of cutting your utility bills in half. To get your hands on this unbeatable combination, see specially marked PC Tools packages at your favorite dealer. Or, for more details, call us at 1-800-445-4073.

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*Requires $10 to cover shipping and handling. PC Tools is a trademark of Central Point Software Inc. 386MAX is a trademark of Qualitas, Inc. All other product names are trademarks of their respective manufacturers.

CIRCLE 749 ON READER SERVICE CARD

by
Gus Venditto

Pipeline

A Look at the Trends Shaping the Personal Computer Market

Multiuser OS/2 from IBM Renegades Will Run OS/2 Applications Right out Of the Box

From day one, one of OS/2's most glaring weaknesses was its inability to run multiuser applications. Extended Edition offered links to databases, and network software vendors quickly built OS/2 compatibility into their operating systems, but anyone who wanted the economical integration that can only be found by running several terminals off a single PC were left out in the cold.

And that has been one of Unix's best opportunities to make gains in its market share in the PC environment.

Enter a band of renegades from IBM led by Ed Iacobucci—a programmer who has been called the Father of OS/2. These renegades have formed a new company, Citrix, and have developed *Multiuser*—software that will take existing character-based OS/2 applications and run them, unaltered, on terminals connected to PCs.

Since most terminals are character-based, the lack of graphics isn't a real issue. A version that would run Presentation Manager on Sun River and Viewpoint systems is possible down the road.

What Citrix *Multiuser* will offer when it's released early next year is the ability to install the OS/2 versions of *Lotus 1-2-3, WordPerfect, or R:BASE* on a single 386, connect a half-dozen or so terminals off the back using serial ports or multiprocessor boards, and give an entire office access to the same files with decent performance—all for less than $10,000.

This is the kind of small business situation where Unix is becoming popular, as consultants are providing a mix of industry-specific applications for companies that don't want the overhead of managing a LAN. Citrix's software will be cost-competitive with Unix solutions—the initial five-user pack will cost about $995 and additional five-user packs will be in the neighborhood of $499. And it offers two key benefits: traditional DOS applications that have migrated to OS/2 will be available, and installation will be simple, since no programming will be needed to set up commercial OS/2 applications.

In adapting OS/2, Citrix had to eliminate the DOS compatibility mode, so it is strictly an OS/2 environment. But the company did build 32-bit extensions, so you can greatly exceed OS/2's current 16MB limit on 386s. Citrix has tested systems running 256MB of available system memory.

Because Citrix has licensed the OS/2 source code, compatibility should not be a problem. All OS/2 1.2 APIs, other than Presentation Manager-related graphics, are included. Named Pipes support will provide links to client-server architectures. Terminal emulation extensions will allow PCs to connect to the system, and Citrix will provide terminal drivers for all popular displays. File-sharing controls are the same as those provided by the individual applications for use in multiple sessions under OS/2.

In fact, Citrix's software may bolster the popularity of PC-to-terminal use because it will use

CONTINUES ON PAGE 68

THE TOP 5 ON-LINE SERVICES

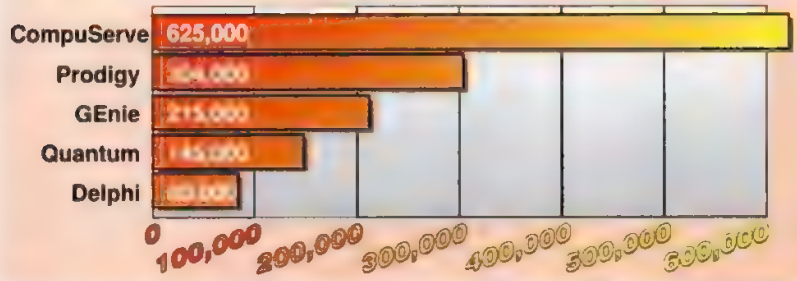
A few years ago if you wanted to find new software, you dialed one of the private bulletin boards and redialed and redialed until you were lucky enough to get in.

Those bulletin boards are still popular, but on-line services—where you pay for access and get through every time—have been growing 20 percent per year since 1987. There are now 1.9 million **households connected to one of 50 on-line services available nationally.**

The five services listed here represent 71 percent of the market; the figures were compiled by "Interactivity Report" newsletter in a survey of consumer-oriented on-line services.

At the same time, shareware has grown right along with it. It has its own trade group (the Association of Shareware Professionals) who recently began publishing a monthly top ten list. The **list here represents sales through disk merchants like PC-SIG, Shareware Express, Public Brand, and CWI.**

THE TOP ON-LINE SERVICES AND SHAREWARE PROGRAMS



THE TOP 10 SHAREWARE PROGRAMS

(August 1990)

1. *ImagePrint* (dot matrix print aid)
2. *Our United States* (geography quiz)
3. *DoubleBlocks* (game)
4. *World 29* (electronic globe)
5. *Kingdom of Kroz* (adventure game)
6. *4DOS* (COMMAND.COM enhancement)
7. *Batutil & Stackey* (Batch file aids)
8. *XTree* (directory manager)
9. *SR-Info* (database manager)
10. *LOTWON* (Lottery aid)

Pipeline

CONTINUED FROM PAGE 67

intelligent display logic built into IBM's 3151 and newer generation terminals. With smart scrolling in the terminals, Citrix is able to take advantage of OS/2's block-oriented screen writing to provide terminal displays that are surprisingly smooth.

Finally, Citrix has built in good administration tools, so managing the system should prove far easier on *Multiuser* than it is on a comparable Unix installation.

This isn't a connectivity solution for every office, but *Multiuser* does fill a big gap in OS/2's repertoire and proves that there is life beyond *Windows*.

AMD AND INTEL BATTLE OVER THE 386'S FUTURE IN FEDERAL COURT

A federal judge will be deciding a significant part of the future of PC development in coming months.

Intel has sued to block AMD from introducing its own version of Intel's 80386 microprocessor.

Intel got a leg up in the case when it won a restraining order, preventing AMD from using the name AM386 in marketing the chip; Intel maintained that the 386 trademark was closely identified with its own product. It's only a small victory, since the order is temporary and Intel was required to post a $1 million bond for potential damages to AMD in the event that Intel's suit is without merit.

AMD has countersued, contending that Intel has misappropriated trade secrets and is engaging in unfair business practices.

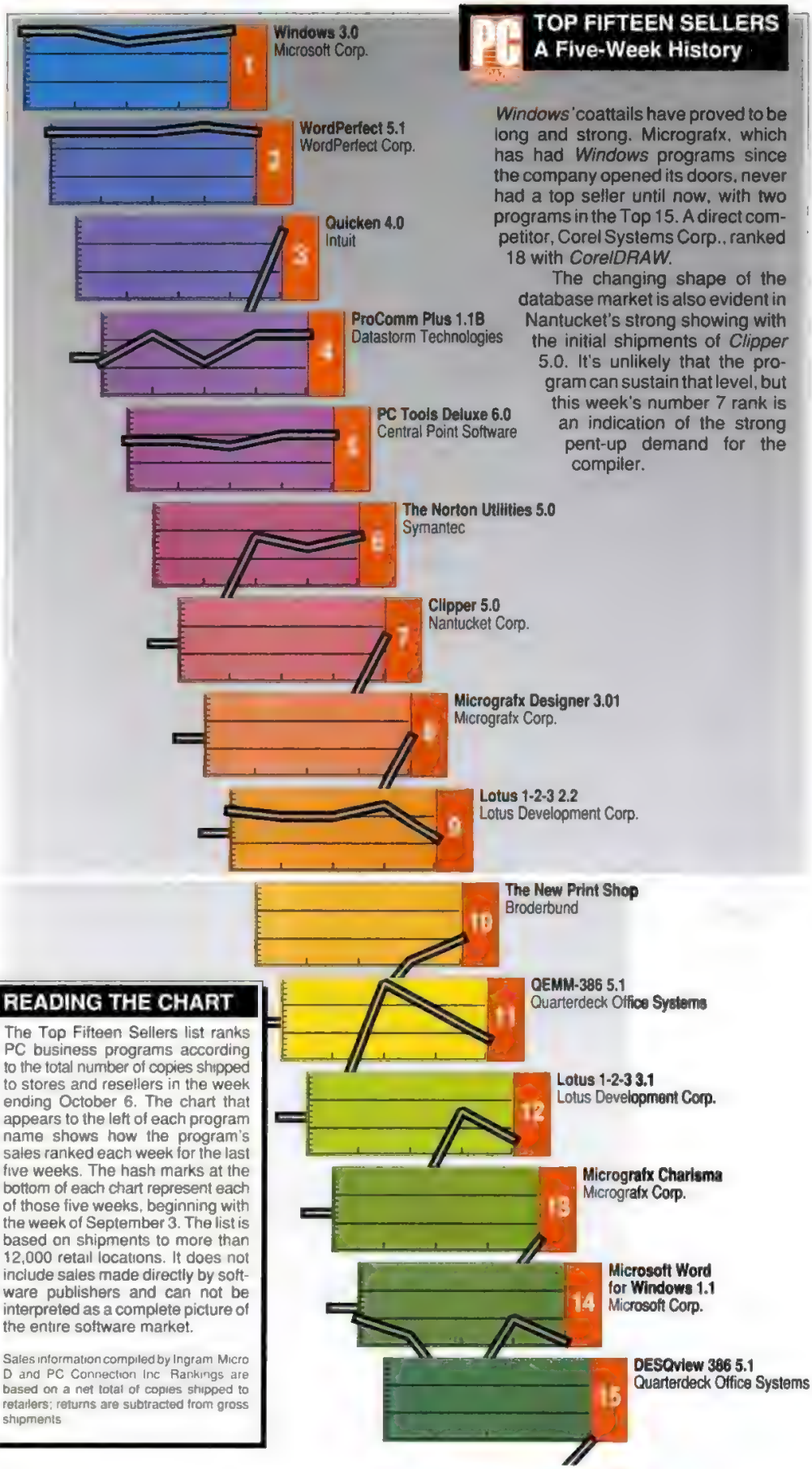
Before the suit was filed, AMD had hoped to unveil its version of the 386 in November.

COMPAQ PROVIDES LIFETIME WARRANTY ON LTE CASES

Reacting to what a Compaq spokesman called the worst product defect to plague the 8-year-old company, Compaq has extended the warranty on the cases

CONTINUES ON PAGE 71

TOP FIFTEEN SELLERS
A Five-Week History



Windows' coattails have proved to be long and strong. Micrografx, which has had *Windows* programs since the company opened its doors, never had a top seller until now, with two programs in the Top 15. A direct competitor, Corel Systems Corp., ranked 18 with *CorelDRAW*.

The changing shape of the database market is also evident in Nantucket's strong showing with the initial shipments of *Clipper* 5.0. It's unlikely that the program can sustain that level, but this week's number 7 rank is an indication of the strong pent-up demand for the compiler.

READING THE CHART

The Top Fifteen Sellers list ranks PC business programs according to the total number of copies shipped to stores and resellers in the week ending October 6. The chart that appears to the left of each program name shows how the program's sales ranked each week for the last five weeks. The hash marks at the bottom of each chart represent each of those five weeks, beginning with the week of September 3. The list is based on shipments to more than 12,000 retail locations. It does not include sales made directly by software publishers and can not be interpreted as a complete picture of the entire software market.

Sales information compiled by Ingram Micro D and PC Connection Inc. Rankings are based on a net total of copies shipped to retailers; returns are subtracted from gross shipments

If you think the LaserPrinter E looks good in person,

wait till you see how it looks on paper.

	The New IBM LaserPrinter E	HP LaserJet IIP
Speed	✓ up to 5 ppm	up to 4 ppm
Speed upgrade option	✓ up to 10 ppm	No
Adobe PostScript option	Yes	Yes
Printer emulation	✓ IBM, HP PCL	HP PCL
Std. plotter emulation	✓ Yes	No
Font card slots	✓ 2	1
Std. input paper tray capacity	✓ 200	50
Std. output paper tray capacity	✓ 100	50
Opt. sec. input paper tray capacity	✓ 500	250
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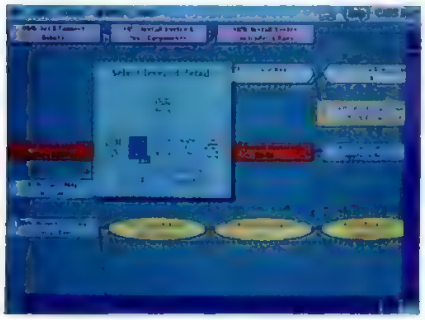
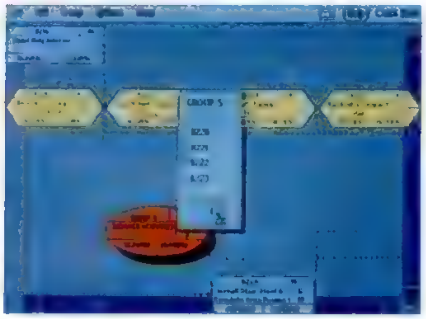


Zoom — five levels of detail for your network, from bird's-eye to close-up.



Explode — The Collapse command compresses several activities into one; Explode redisplays activities in their original positions.

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CIRCLE 148 ON READER SERVICE CARD

Pipeline

CONTINUED FROM PAGE 68

of the LTE and the LTE/286 portables for the life of those systems.

Many LTE cases have developed hairline cracks. In September, Compaq announced that it was changing the plastic used in those cases and would make replacement cases available through its dealer network.

An LTE owner who finds a problem in the case should return it to his dealer for a replacement.

More than 100,000 LTEs have been sold.

NCR CATCHES HP'S NEWWAVE

As part of a campaign to build a reputation as an innovator, NCR has announced plans to offer a customized version of HP's *NewWave*, the object-oriented front end to *Windows*.

According to IBM, 3,395 identification numbers had been assigned to Micro Channel cards, as of the middle of 1990.

NCR is calling its software *Cooperation*. It will simplify communications tasks, such as moving application-specific files from one computer to another.

This kind of front end is becoming a key strategic element for every manufacturer who wants to sell both mini and micro computers. It's seen as a necessary response to IBM's OS/2-based *OfficeVision* system.

MICRO CHANNEL GROUP HOPES TO SPUR DEVELOPMENT, EASE CONFUSION OVER STANDARDS

Until recently, Micro Channel compatibles persisted in making their way to market, in spite of fuzzy ideas about what the Micro Channel standards were (see the October 30, 1990, issue of *PC Magazine*).

Now, IBM is finally lending a hand to companies that are developing peripherals and Micro Channel-compatible systems.

This fall, the Micro Channel Developers Association was formed by 14 companies that have already invested in MCA products. IBM is an equal member of the association and, while the other 13 clearly see IBM's participation as a chance to voice their concerns to the standards maker, IBM sees its participation as a chance to disseminate accurate information about the MCA standard.

According to IBM, 3,395 identification numbers had been assigned to Micro Channel cards, as of the middle of 1990. ■

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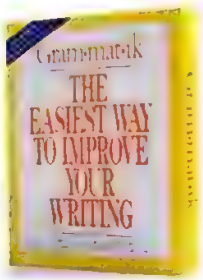

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CIRCLE 534 ON READER SERVICE CARD

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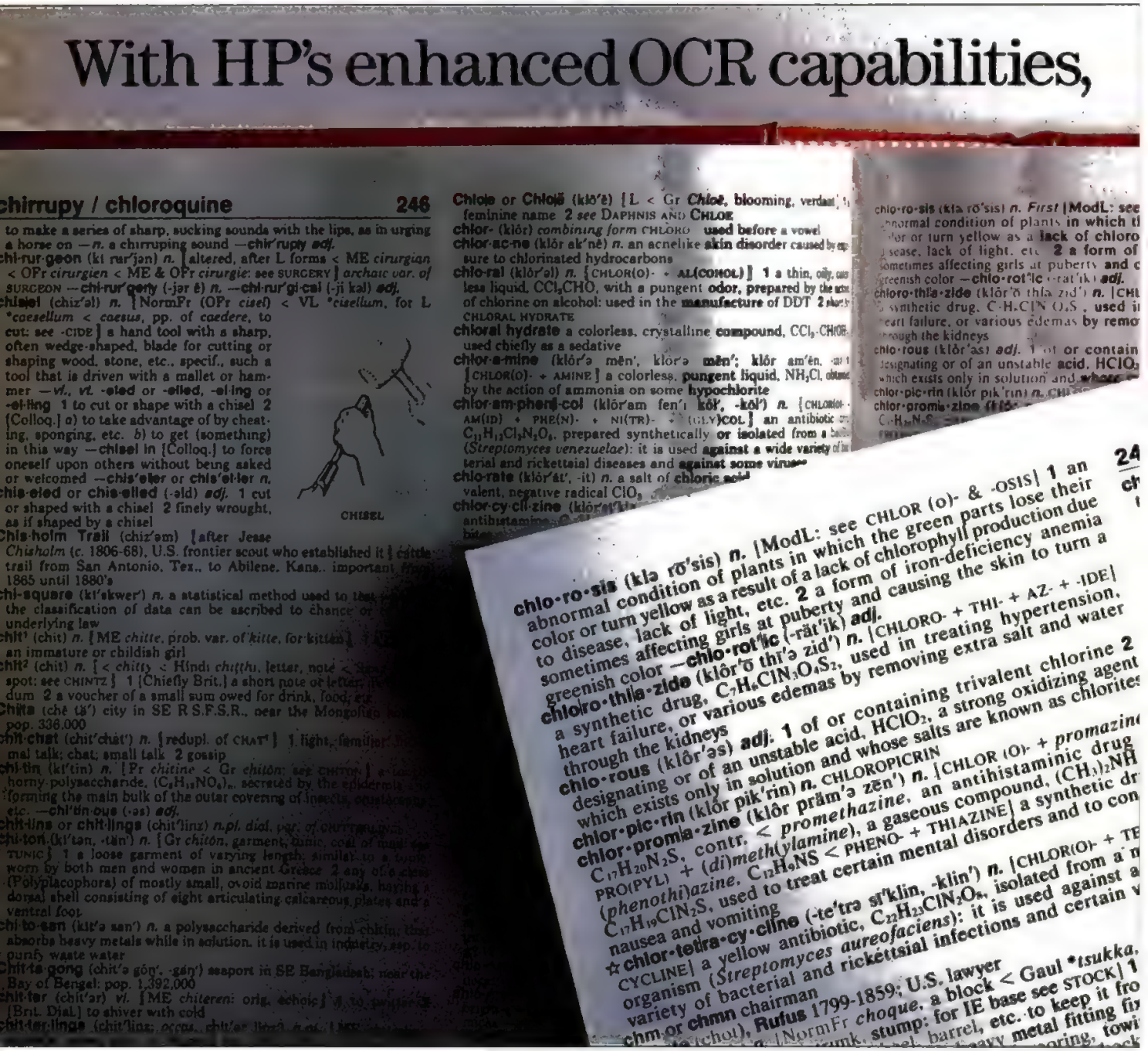

Now you can take a page of this. A paragraph of that. Combine them with a few images. And quickly come up with one very impressive document. The HP ScanJet Plus scanner can read everything from a magazine article to a balance sheet. Then it stays on the job so you can easily fine-tune, or make major changes to, everything you've scanned.

The affordable, 8-bit ScanJet Plus is supported by a wide variety of third-party OCR and graphics software packages. HP's optional

it's easy to make chocolate moose.

text scanning software, AccuScan, simplifies the scanning process by recognizing the layout of even the most complicated material. Including multi-column pages and numerical tables. AccuScan automatically separates text from graphics, making it easy for you to pick and choose the information you want. An optional twenty-page automatic document feeder makes you even more efficient.

The ScanJet Plus gives you a head start. With one-button automatic text scanning. Live preview for instant feedback on image quality. And auto exposure, which works like a point and shoot camera. To make things even easier, it features on-line help.

HP has added all these impressive capabilities to a scanner known for its superior image scanning. The ScanJet Plus reads 256 levels of gray for smooth shading and more realistic graphics.

At only $2,190* the ScanJet Plus makes perfect sense for any business interested in being more productive. And more professional. For more information and the name of your nearest authorized HP dealer, call **1-800-752-0900, Ext. 1666.** And even if you never make chocolate moose, you'll have a recipe for success.

HEWLETT PACKARD

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Another clear advantage is Charisma's compatibility with Windows 3.0 which conveniently pops hundreds of options on the screen for rapid experimentation. Browse through chart types, clip art, 42 outline typefaces, perspective chart effects, colors, gradients, chart templates, and free form layouts, to name a few.

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Bill Machrone

In The Driver Seat

If you ever needed a reason to own a modem, now there's a compelling one: to keep up with the assault wave of new drivers.

Suboptimal. Now there's a word for you. Condemning while offering the promise of more, it's probably an apt description of your computer system. Fortunately, it's fixable.

It's next to impossible to keep your system up to date. New drivers and software updates continually emerge. I just updated a number of drivers, and I still haven't caught up.

Here at the office, we've been having problems with *Windows* in 386 enhanced mode trashing files across our *NetWare* network. That's kept us from using all of *Windows'* multitasking capabilities. The art department, which uses programs such as *PageMaker, Micrografx Designer, Arts and Letters,* and *CorelDRAW,* hadn't bothered to upgrade from *Windows* 2.01. Standard mode didn't offer enough advantages over what we had. Microsoft and Novell, of course, disavowed all knowledge of the problem and assured us, in the tradition of data processing, that it was the other guy's fault. Some sleuthing on the part of Jim Galley, our new director of PC Labs, determined that the driver for our Proteon twisted-pair Token-Ring cards was at least partly to blame. He downloaded a copy of the latest driver from Proteon's bulletin board. He installed and tested it, and it looks like our networking problems are solved.

The upshot: a problem that's been plaguing us since *Win* 3 was introduced was put to rest in a couple of hours. This was after repeated calls to the vendors and visits from high-priced consultants. The latter consulted their astrological charts, muttered incantations, and told us that it was static electricity and we'd have to live with it.

NEW MATH

A number of us have NEC Graphics Engines or other high-performance video cards in our systems. If we waited for NEC to send us updated drivers for *Win* 3 we'd wait a long time, indeed. Is that a criticism of NEC? Hardly. Not only is it unrealistic to expect manufacturers to keep you updated with drivers, but it's unfair as well. This has nothing to do with consumerism or taking sides with the manufacturer. It's simple arithmetic.

Let's say a manufacturer puts out a Super VGA card. He's sold a couple of hundred thousand of them in their year-long production run. He's dropped the price as manufacturing economies and competition dictate. Suddenly (or not so suddenly in this case), *Windows* 3.0 hits the scene and people start clamoring for 800 by 600 drivers or 256-color drivers. The manufacturer may be looking at upgrading a quarter to half his installed base.

Since only 10 to 15 percent of owners register products such as video cards, there's no practical way to notify owners when new drivers are available, so the contact has to be initiated by the owners. Large sites take care of themselves—they can distribute drivers internally with reasonable efficiency. Individual owners are the problem. Typically, the more-motivated users call and demand to be sent disks. It costs the manufacturer money to answer the phone, process the request, to prepare and mail a disk. Where will this money come from? The revenue from selling the original boards has already been absorbed by the usual overhead expenses, reinvestment in research and development, and distributed profit. Yet people get upset when vendors charge for new drivers.

ILLUSTRATION: JOHN LABBE

Manufacturers that maintain bulletin boards can easily accommodate the demands of the installed base for new drivers—if the users have modems. I find it shocking that less than a third of the installed base of PCs are equipped with modems, given their low cost and high utility. It opens up a whole world of soft-

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CIRCLE 174 ON READER SERVICE CARD

ware updates, downloadable utilities, and access to electronic services such as fax and e-mail. Readers have done more than a million downloads of *PC Magazine* utilities from PC MagNet. They tap into a world of free software and shareware. They even get technical support and advice from knowledgeable people. They stay current in a way that even the most dedicated magazine reader cannot hope to equal.

IF IT WERE EASY...

Granted, asynchronous communication is one of the gnarliest aspects of PC use. For all the standards that exist, it remains one of the hardest areas to learn well; communications packages are idiosyncratic and unintuitive. Every service or bulletin board you call has a different user interface, different protocols for connecting, different ways to sign on. Your nice, neat, digital signals are subjected to the vagaries of the dial-up phone network. Still, the benefits far outweigh the hassles.

Some users will always gripe that modems are too expensive or that on-line charges are too high, even though virtually all manufacturers' bulletin boards are free. These Luddites are a business opportunity. An entrepreneurial person could, with appropriate manufacturer permissions, gather together drivers, advertise their availability, and sell them at reasonable cost to the comm-adverse. Perhaps the service could be structured like an insurance policy, where you pay an annual fee in exchange for the assurance that your system will always be up to date. I also wouldn't mind seeing vendors offering upgrade kits that, for a reasonable cost, offered all their latest drivers. One of the ways for them to add value is with a state-of-the-art installation program that examines your system, offers you some choices, and replaces old drivers with new ones quickly and easily.

IBM recognizes the nascent revolution in on-line support by delivering each and every PS/1 with a 2,400-bit-per-second modem, a Prodigy subscription, and the chance to join Promenade, a paid service with higher levels of support. None of the PS/1 support programs or policies is new. It's just the first time a major company has decided to support a product that way.

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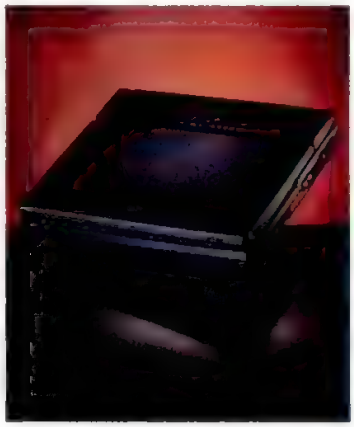

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CIRCLE 723 ON READER SERVICE CARD

John C. Dvorak

Looking Back at A Slump

Is the personal computer industry reliving the boom and then bust experience of 1983 and 1984?

It was when *PC Magazine*, a few months back, cracked through the 550-page mark on the heels of a 500-page issue, that I realized that we're in another industry boom. Not to take anything away from the *PC Magazine* sales force, but even they have to admit that the magazine would not be so thick if the industry were sick or in a recession.

The last time we saw such a boom was just before the only massive slowdown the industry has experienced, which was after the boom year 1983. That was the year that held the thickness record for the Comdex show guide. In 1984, things cooled fast.

Are there any parallels between 1983 and 1990 that we can spot to indicate a repeat of the 1984 cooling off? Well, one indicator is the aforementioned monstrous issue size of *PC Magazine*. The Volume 2, Number 7 (December 1983) issue of *PC Magazine* hit a whopping 774 pages! That record-breaking issue forced the magazine to come out twice a month. Then came the PC*jr*. The PS/1 now arrives at a similar moment.

An attempt to find more parallels, though, fails miserably. The business has changed. Back in 1983 there wasn't the hot clone market there is today. In fact, there were only five advertising clones: the Compaq Portable, the Chameleon, the Columbia, the Explorer 88, and the Tava PC. Direct sales weren't discovered by the PC cloners back then and you were expected to find these clones at the local ComputerLand or CompuShack.

There were an inordinate number of computer stores advertising; something you don't see too much of nowadays. Also, *PC Magazine* was filled with game advertisements. IBM was advertising, too. It was advertising furniture from (I guess) its furniture division. In this case, there was a silly roll-about PC station that could be closed up into a cube. It was called the IBM Synergetix PC Work Station. IBM even trademarked the name Synergetix and patented the cube as if it were to become a phenomenon. I've never seen it since.

It wasn't clear in 1983 what database software would dominate. Ashton-Tate was fighting for its life with the *Condor* relational DBMS; there was *Revelation* from COSMOS, the ALPHA DBMS and scads of others.

The magazine was filled with near-success stories such as *Offix* from Emerging Technologies. This looked to be a forerunner of a slew of similar products that used the idea of an icon-based file cabinet. Experimental marketing and an unsure public didn't help.

The fat December issue was when *PC Magazine* spun off two experiments that failed (and we don't talk about them anymore). One was *PCjr Magazine*—a magazine of wishful thinking. The other was *PC Disk Magazine*, a forerunner of many attempts to convince people that they should buy disks full of programs the way they subscribe to a magazine.

During boom times, it's difficult to focus because money is flowing like crazy and nobody knows what they're doing. In 1983, *PC Magazine* wasn't anything like today's magazine, which is targeted on intensive reviews and definitive technology analysis. Like the industry, it was trying to find itself in the midst of a sea of cash and enthusiasm.

This is the key to understanding then and now. Looking back on the 1983-1984 mini-

ILLUSTRATION: JOHN LABBE

boom, minibust, we discover there isn't much to learn from that period. If anything, we can see that the level of enthusiasm for the business was unwarranted for 1983. But it was warranted for a future six years further out. Those who went for the long-term stick-to-it approach to the business did great. Those who were caught up only in the mood of the raucous moment failed. If another bust comes, we can be sure the pattern of failure will be the same.

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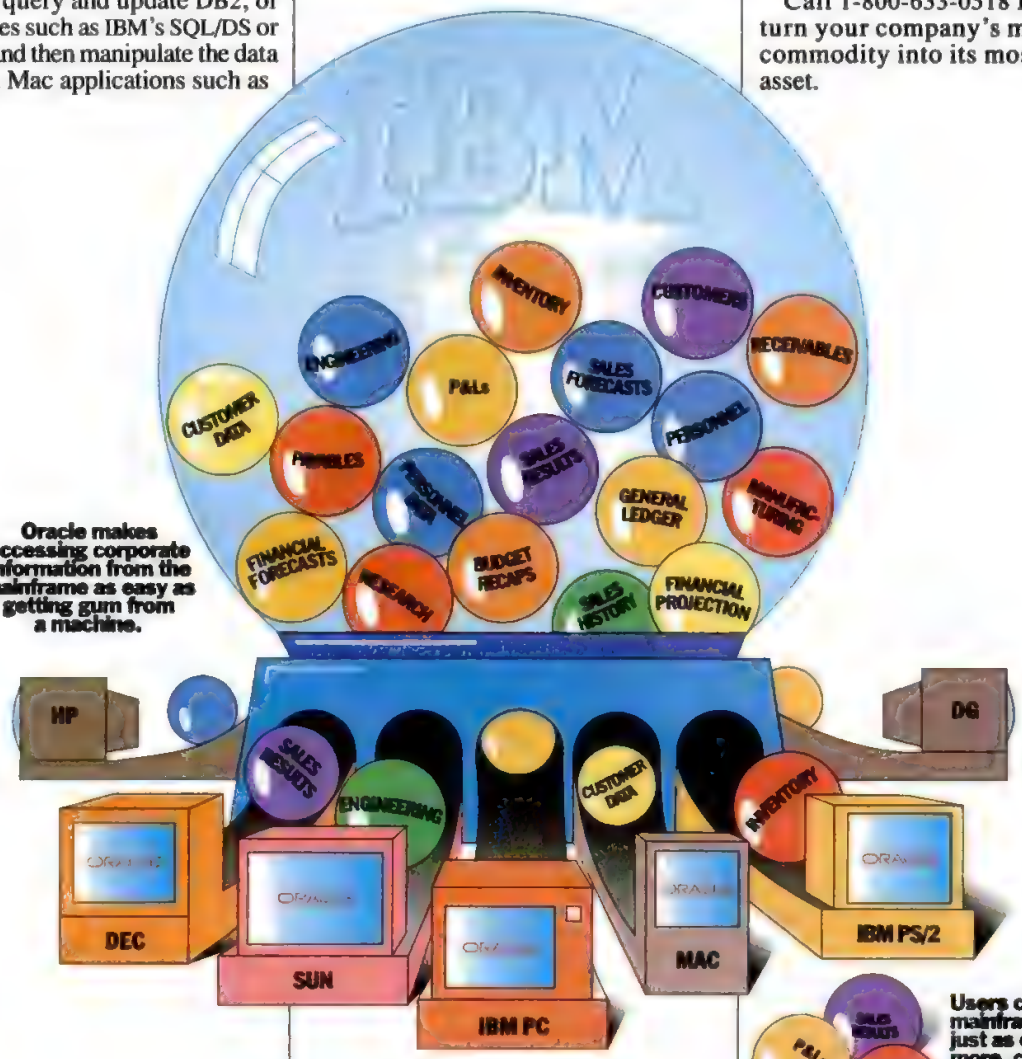

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John C.
Dvorak

Inside Track

Behind the Scenes Dept.: The year has not been a good one for innovation. Each year *PC Magazine* polls its staff to determine the nominees and winners of the annual *PC Magazine* Technical Excellence Awards, which are handed out at Fall Comdex. Everyone remarked that there were noticeably fewer new and innovative products released in 1990. Software seems especially hard hit. It's as though **everyone is waiting** for some new technology to break.

I found things **so boring** I didn't even attend the Steve Jobs rollout of the latest NeXT machines in San Francisco. His **innovation** this time was to **retrofit floppy disks** onto the machines, add color, and lower the price. Wow.

Buzzwordsmanship Dept.: Anyway, you know things are really slowing down when instead of genuine new technology we get new buzzwords and **artificial concepts.** When IBM rolled out *Office Vision* a few years ago in a flurry of announcements, it introduced a term called "Data Warehouse" to describe a mainframe. Nobody picked up on this **clever term** because there were too many real products and actual innovations to write and talk about. If the term were introduced today, arguments would ensue. Editorials would be written. IBM's **last big success** in buzzwordsmanship was the term "connectivity," which has to be in the **top five** all-time list.

The term "connectivity" showed up during one of the slow times in the LAN business, so it caught on. The rule is simple: **When things are slow don't introduce new technology, introduce new terminology.** Maybe that will save the day.

Enter Xerox Corp., a company that 's **squandered** more technology and opportunities than you can imagine. Apparently it wants to get into the terminology business now, so it has begun using the **latest buzzword** floating around the industry to flog a new line of computers. The term is (get ready to cringe) "Interpersonal Computing." The invention of this term is credited to the aforementioned Steve Jobs, a master of buzzwordsmanship. His last big hit was "knowledge worker."

We are no longer in an age of personal computing, they say. We are entering **an age of interpersonal computing.** What malarkey. What is this nonsense supposed to mean?

Xerox, a company long on ideas and short on marketing, seems to think it has discovered something new. The more you listen to the pitch (and its **wacky terms** like "docuspace") and see its supposedly new concept—the **GlobalView environment, new workgroup computing**—the more you realize that **Xerox has reinvented the paperless office.** The paperless office was part of a 1970s fad called Office Automation. Office Automation was going to do for the office what the assembly line did for the factory...somehow. Exactly why anyone would want to turn a pleasant office into a **grim assembly line peopled by drones** doing the same miserable, boring, and repetitive work all day always mystified me.

The day the term "paperless office" was invented was probably the best day to **invest your savings in a paper mill.** The paper mills have been working overtime to keep up with the demand for paper like never before.

> The day the term "paperless office" was invented was probably the best day to invest in a paper mill.

So Xerox wants to create and move paperless documents around the globe in some sort of seamless network that ignores the **ugly reality of connectivity.** The reality is that there is no reliable feedback mechanism in the true interconnect world of paperless communications. You can send a message out to Joe Doe, but rarely can you be sure he got the message. This inherent defect is an **anathema to communications**, and communications is the key to success.

Unless the office is completely reinvented (something no large company seems willing to do), the **old-fashioned office** where people have to initial actual paper memos and pass them along will **always outperform a paperless office.** In a paperless office, cheating the system is rewarded. "I never saw that memo. He didn't send it to me. Didn't you get my response? I outlined the problem in detail. What happened?"

It's no coincidence that Xerox and other companies which sincerely try to prove the workability of the paperless office by implementing **radical new ideas** are the same companies that fall behind in innovation to more-traditionally organized companies. A smart company will not be fooled into believing that the traditional office will go **the way of the dodo bird** once workgroup computing catches on.

So it goes with "Interpersonal Computing," **as hollow and meaningless a catch phrase as ever there was.**

Genuinely Interesting Software: While I vowed not to look at any *Win* 3 applications until 1991, I couldn't pass up saying something good about *Image Prep*, from Computer Presentations Inc. (1117 Cypress St., Cincinnati, OH 45206; 513/281-3222). This $295 graphics utility is the first I've seen for the PC which offers true **Macintosh-like power** in desktop publishing image manipulation. Running under *Windows* 3.0, essentially it can prepare and convert just about any video image, turning it into a file usable with just about any desktop publishing package. It includes **new image compression algorithms** so it can compress those huge 24-bit color files by 30 to 1 without degradation. If you do desktop publishing on the PC, **you must have this package,** believe me. ■

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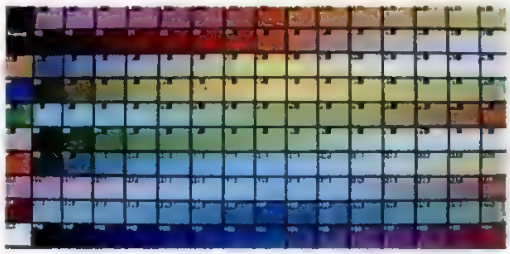

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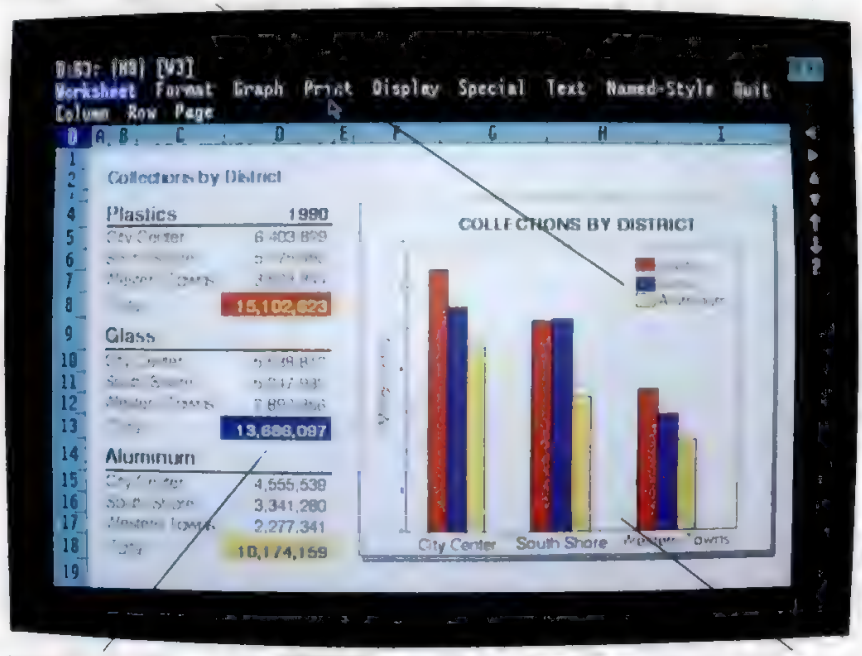
Q4 ✓	1989
2,415,407	6,886,910
1,987,897	5,573,029
1,331,601	3,789,665
5,734,905	16,249,604
3,61[illegible]29	12,860,958

Create drop shadows, borders and legends.



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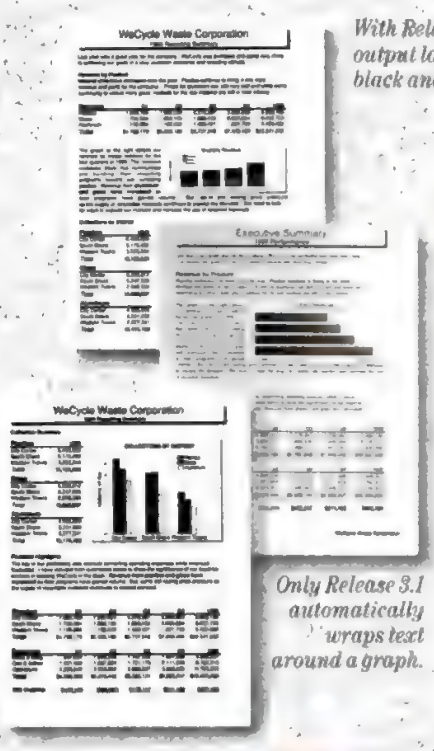

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1990 Recycling Summary

Last year was a good year for the company. WeCycle was profitable and came very close to achieving our goals in a very uncertain economic and recycling climate.

Revenue by Product

Material collections increased over the year. Plastics continue to bring in the most revenue and profit for the company. Prices for aluminum are still very soft and while we're continuing to collect more glass, markets for the raw material are still in their infancy.

Revenue	Q1	Q2	Q3	Q4	1990
Plastics	1,890,785	1,982,024	2,378,397	2,836,983	9,088,189
Glass	1,700,504	1,862,135	1,869,430	2,600,684	8,032,753
Aluminum	1,146,884	1,182,022	1,489,421	1,601,783	5,420,090
Total	$4,738,173	$5,026,180	$5,737,248	$7,039,450	$22,541,032

Only Release 3.1 automatically wraps text around a graph.

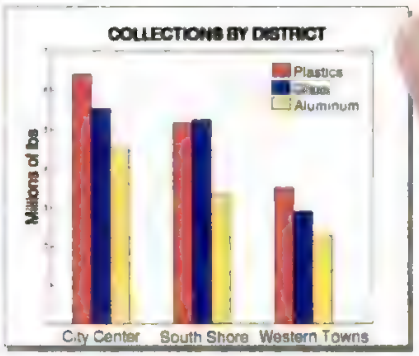
The graph at the right details our revenue by waste material for the four quarters of 1990. The revenue increases show that communities are building their recycling programs beyond just collecting plastics. Revenue from **aluminum and glass have increased** as their programs have gained volume. But, we're still seeing price pressure as the supply of recyclable materials continues to exceed the demand. We need to look for ways to expand our markets and increase the use of recycled materials.

Collections by District

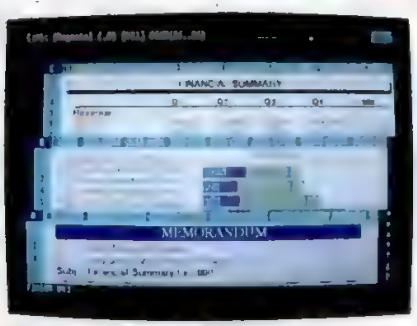
Plastics	1990
City Center	6,403,829
South Shore	5,175,450
Western Towns	3,523,344
Total	[illegible]

Glass	
City Center	5,538,812
South Shore	5,247,930
Western Towns	2,899,356
Total	[illegible]

Aluminum	
City Center	4,555,539
South Shore	3,341,280
Western Towns	2,277,341
Total	**10,174,159**



Release 3.1 runs in Windows 3.0. Just click the icon and you're on your way.



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ıalytically. Think Confidently.

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Jim Seymour

Corporate Strategic Alliances II

If vendors don't improve their strategic alliances with corporate accounts, every one of us will suffer.

The strategic alliances forged over the last few years between major corporate PC buyers and the computer-industry vendors upon whom they rely are important for everyone who uses a PC.

Hardware and software vendors use these large corporations for feedback on the changes needed in existing products, and on the unmet needs that still cry out for PC answers. It's a two-way street: Close relationships with their primary suppliers give large PC buyers and the users they support insight into vendors' plans for extending their lines, upgrading their products, and revising the way they deliver those products in the Age of Connectivity.

Those relationships are in big trouble.

I've traveled across the country over the last six months, asking executives of large PC vendors and corporate MIS and Info Center managers alike what they thought about *their* strategic partners, and whether they thought the system worked. I got an earful: Neither side thinks much of the present system.

I listed here last time some of the complaints from both sides of the strategic-alliance fence. Corporate buyers think the PC hardware and software houses they rely on pump them for tips on improving their products, without necessarily delivering those improvements. Too often, vendors try to turn what is supposed to be a cooperative forum into a selling tool.

Vendors say strategic alliances with their customers have become a joke, because those customers have decided they know better than the hardware and software chiefs how to run the PC business. And corporate people often don't buy those new products that were created specifically to please them.

My conclusion: After hearing both sides, and serving as a kind of runner between them for months, I must side with the corporate people. Their complaints are legitimate, and must be addressed.

Too often vendors *have* tried to turn these alliances into one-sided "account control" schemes to keep big customers in line by dangling carrots in front of them. Too often, those carrots disappear once the customer decides to stay on-board through another round of upgrades.

How can we fix this?

Vendors need to bring more openness and trust to the table. Corporate PC managers say they're tired of spending hours and days sitting down with vendors' traveling teams, or going to vendors' Corporate Advisory Council sessions, only to get vague statements of direction in return. And not only do corporate people want more-concrete information, they want stories that don't change.

A West Coast PC manager at a very large company angrily told me about his frustration with a major software vendor. The manufacturer repeatedly said it would do a *Windows* version soon. The manager kept the product on his company's core-software list, waiting for that *Windows* version, even delaying the move to make *Windows* a corporate standard.

Then the company told him it wouldn't do a *Windows* version after all. So he went through the enormous effort of persuading his superiors and his users to move to a competitive product which does run under *Windows*. One of his arguments was that the program manufacturer had given him a definitive answer: The company wouldn't be doing a *Windows* version.

ILLUSTRATION: JOHN LABBE

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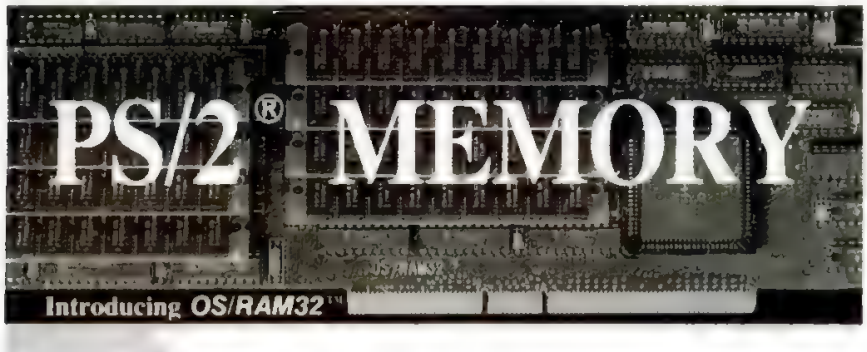

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Jim Seymour

You can't imagine the amount of abuse he says he took from users whom he'd switched, in good faith, away from that product to another "because those S.O.B.s told me they'd never do a *Windows* version." Nor how far he believes his stock has fallen with those users and his bosses.

"They've gotta tell us more. And they've gotta tell us the truth," he said.

His story was appalling, but hardly unique. Many PC managers believe they've been led down the path by vendors—often, companies they've supported with millions of dollars worth of purchase orders.

Many of the PC coordinators I spoke with said they were angered by vendors' efforts to turn their participation on advisory councils into commitments to the vendors' products.

"They fly us around, or they come to town and lay on a big dinner," one PC manager said, "all in the guise of getting our input. Then they turn it into a sales call, with slide shows and speeches about how great that next product will be. But they won't tell us anything useful about the product, just that it's going to be hot.

"When we ask questions they say they're sorry, but they're not on the technical side. They'll 'get back to us.' But they never do.

"Why don't they send some of their technical people around in the first place, so we can find out what's really coming? And so we can explain what we need to people who'll understand.

"We finally decided the hell with it. We'll listen to what they say, but we're not going to waste our time redesigning their products for them any more."

EVERYONE LOSES

When the people most directly in touch with large groups of real-world PC users stop passing along information to vendors about the users' needs, you and I wind up with a poorer choice of new PC products.

There's an enormous opportunity here for vendors to re-create their strategic partner programs, in ways which make the corporate participants *real* partners. Sooner or later some will, and they will prosper mightily from their good sense and good faith.

But why only some? And why not sooner, rather than later? ■

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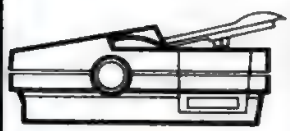

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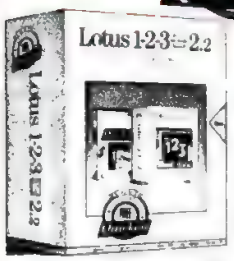

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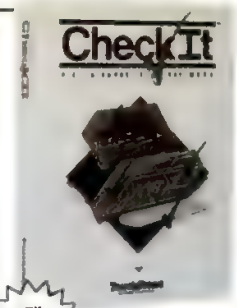

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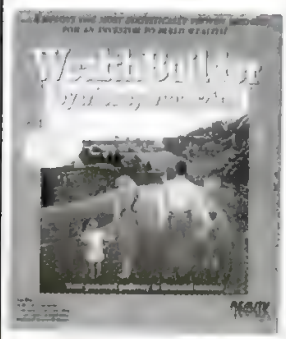

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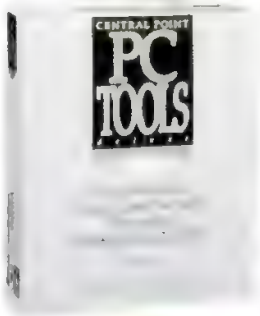

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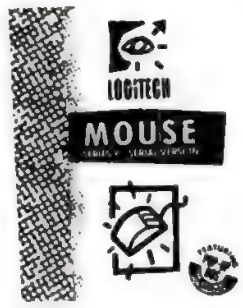

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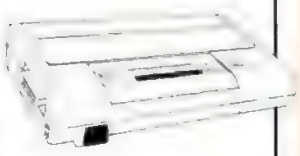

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William F. Zachmann

Upsizing: The Other Half of the PC Equation

Through the increased functionality of PCs and software, micro-based technology is coming to thousands of small businesses.

Six weeks ago, I revisited the topic of "downsizing" (*PC Magazine*, October 30, 1990). That's the word I've used since 1985 to talk about overwhelming "economies of small." It describes the micro revolution and the eventual replacement of most traditional mainframe and minicomputer systems with microprocessor-based alternatives.

Upon further reflection I've realized that downsizing, important as it may be, is only part of the picture. Another, equally important aspect is what I've chosen to label "upsizing."

"Upsizing" refers to the widespread and growing trend to use personal computers for larger and more-sophisticated applications not previously used in a particular organization.

Some might argue that "downsizing" and "upsizing" are merely two different aspects of the same underlying phenomenon. It is certainly possible that what is called "downsizing" from the perspective of the glass-walled, air-conditioned, raised-floor computer room may also be called "upsizing" from the perspective of the desktop.

However, while "downsizing" and "upsizing" are both rooted in the same technological transition, they address significantly different situations and user populations. Downsizing will normally define the primary situation for larger organizations with an extensive investment in mainframe and minicomputer systems.

Upsizing characterizes the situation of smaller organizations with little or no investment in traditional information systems. It is a better word to describe the situation of small- and medium-sized businesses, as well as the many smaller units in large organizations.

The primary motive for downsizing is purely economic. Large organizations can save money by utilizing microprocessor-based systems wherever possible in the place of more-expensive mainframes or minicomputers.

Upsizing, on the other hand, means that a smaller organization is able to automate critical operational or decision-making tasks for the first time. Inexpensive micro-based technology makes application systems affordable that just weren't possible at traditional mainframe and minicomputer prices.

PUTTING PCs TO WORK

There has been an enormous explosion in PC-based systems for retail establishments in recent years. Thousands of bars, restaurants, book stores, and clothing shops that were too small to afford minicomputer systems have been installing microcomputer-based systems to run their businesses. For a large supermarket, the micro revolution may mean downsizing from a minicomputer to a microcomputer-based system. But for the greater number of small retail establishments, reality is upsizing: from no automation at all to a first system made affordable by networked PCs.

Similarly, upsizing characterizes what is really going on for the thousands of smaller offices of doctors, lawyers, accountants, financial advisers, architects and other professionals, small manufacturers, sales representatives, insurance agents, real estate agents, and countless other small businesses.

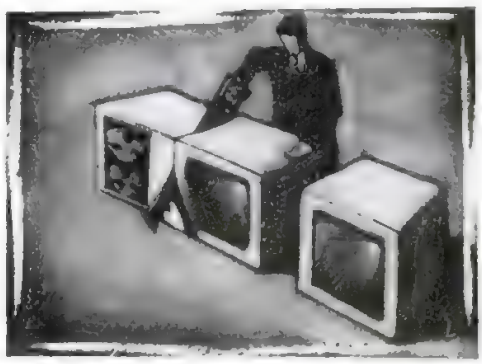

ILLUSTRATION: JOHN LABBE

In many cases, this is done through the purchase of software that is specific to a particular type of business from a value-added reseller (VAR) specializing in "vertical market" software. Also, some broad-based computer resellers like MicroAge have made a point of acquiring an inventory of such applications. Sometimes individual proprietors of

small businesses go from using basic spreadsheet and word processing packages to developing business applications of their own.

In addition, a large number of consultants all over the country assist small- and medium-sized businesses in developing more-sophisticated applications on micro platforms. Varying widely in experience and skill, they nevertheless offer badly needed assistance to smaller organizations trying to take advantage of the opportunities that upsizing provides.

Despite the growing availability of software specific to particular types of business, the initiative of proprietors learning to make more-sophisticated use of personal computers, and numerous individual consultants, the largest single obstacle to upsizing remains the lack of sufficient expertise to do the job effectively.

For every small business with suitable software already available, there are many more for which no existing package is adequate. For every proprietor able to work out his or her own system, there are dozens without the time, initiative, or ability to do so. For every business lucky enough to have a capable consultant, there are numerous others with no such assistance or (worse) getting wrong advice.

Large organizations interested in downsizing applications normally have information systems expertise already in house. The use of personal computers, networks, servers, and larger microprocessor-based systems may, of course, require some relearning by mainframe- and minicomputer-oriented IS personnel. Most, though, have substantial skills that can be applied to the new environment.

Upsizing, however, frequently means that an organization will be using information systems for the very first time. Even though particular employees may be familiar with PCs, experience with more-sophisticated systems may be minimal or absent entirely.

The gap between the opportunities that upsizing provides for small- and medium-sized businesses and the available level of technical and systems knowledge to take advantage of those opportunities may itself provide one of the most significant new business opportunities for tomorrow.

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Word Processors:

The Best and the Brightest

Ami Professional, DisplayWrite 5, Microsoft Word, Word for Windows, MultiMate, Professional Write, WordPerfect, and WordStar are today's most popular word processors. Are you using the right one?

by Edward Mendelson

No one has estimated the number of words the average computer processes during its lifetime, but the amount could easily be in the billions. In the age of graphical user interfaces and three-dimensional spreadsheets, word processing is still the primary function of most personal computers, and the most hotly competitive market in PC software.

A few years ago, analysts predicted that the advent of the word processor would be followed by the paperless office. Instead, the computer has led directly to the greatest increase in paper consumption since the early days of movable type. As word processors have grown in power and flexibility, they have made it possible to print documents with a complexity and elegance that was available only to professional print shops not

MODEL: MICHAEL MILLER PHOTOGRAPHS: THOM O'CONNOR

so many years ago. And they have made it possible to format book-length documents in minutes. But the very latest generation of word processors can do something more. They let you create an automated document of a kind that was never possible before. An automated document can collect data from a spreadsheet or database, transform that data into a graph, prompt a user to enter additional data, and then issue commands that will cause the document to print itself or transmit itself via electronic mail to a remote computer for further automated processing.

GRAPHIC DETAILS

Almost three years ago, in the February 29, 1988, issue of *PC Magazine* ("Word Processing: Fast, Flexible, and Forward-looking"), we tested 55 word processing programs ranging from simple memo-writers to enormous corporate and professional packages. The best packages avail-

EDITOR'S CHOICE

- **Character-based word processors: Microsoft Word, WordPerfect**
- **GUI-based word processors: Ami Professional, Microsoft Word for Windows**

Most users have a monogamous relationship with their word processor—although many established this relationship after a divorce from their first hastily chosen program. If you're comfortable with the program you use, don't let anyone convince you to switch—even if it's one that few others could bear to be in the same room with—because it would probably be harder to acquaint yourself with a new program, even if it's friendlier or more glamorous.

If you do plan to switch, for yourself or your organization, decide whether you plan to remain in the character-based DOS world or move onward to the brave new world of GUIs. That's a decision your computer may make for you: Unless you have a 20-MHz 386- or 486-based machine, a character-based program will give you far better performance. Of course, the ease of using a GUI-based program may outweigh the speed penalty.

Among the top-selling character-based word processors, the clear winner is *WordPerfect*. No other program includes its range of options, conveniences, or high-powered functions. Its pull-down menus provide an easy alternative to its sometimes recalcitrant function-key interface. Its printer control is unmatched among PC software, and it supports every printer in the known universe. Its macros and mail-merge make possible a highly automated office, and it stands at the focus of a growing industry of add-ons. You can trade files with *WordPerfect* versions for virtually every other major computer platform, and *WordPerfect Office* integrates *WordPerfect* with local and wide area networks. Toll-free support remains an inestimable bonus.

Where *WordPerfect* is weakest, *Microsoft Word* is strongest. *Word*'s collapsible outlining and easy-to-manage formatting via stylesheets should by now have been emulated by every other word processor, but nothing else comes close—except *Word for Windows*. The DOS version of *Word* is also strong on macros and merge, and its eight editing windows—including windows for footnotes and annotations—make complex editing tasks a breeze. Loyal users are about to face Version 5.5, which completely overhauls the quirky *Word* interface but adds no new functions. Unlike *WordPerfect*, with its combination of pull-down menus and function keys, *Word* won't let you use either interface interchangeably; you have to install the new or the old.

PC Magazine's earlier character-based Editor's Choices still hold their own. *XyWrite* and *Nota Bene* (built around the *XyWrite* engine) provide editing options unavailable even in *Word* and *WordPerfect*. *XyWrite* remains the mainstay of the publishing industry, while *Nota Bene* offers the best academic word processing. New versions of both are expected soon.

Among GUI word processors, *Ami Professional* has the friendliest interface and the widest range of functions, including charts, drawing, and bitmap image enhancement. With its frame-oriented layout, it straddles the border between word processing and desktop publishing packages and is easier to use than almost any program with comparable powers. The most surprising thing about *Ami Professional* is that when you try the most straightforward way to do anything, it almost always works. *Ami Professional* can exchange files with its smaller sibling *Ami*, which has many strong word processing functions but lacks advanced graphics features.

With its innovative fields and highly programmable macros, *Microsoft Word for Windows* breaks new ground in PC software. More complex and difficult than *Ami Professional*, it also includes a deeper and fuller set of word processing features and manages to avoid virtually all the function-limiting compromises found in GUI programs. *Word for Windows* is as fine and powerful a graphical word processor as the best character-based programs. Some of its menus are tricky, but it makes automated documents of a kind you've never imagined.

An honorable mention goes to *Professional Write*, a professional-class program that lacks many of the high-powered functions of more-expensive packages but includes an impressive number of features. *Professional Write* carries the typewriter metaphor a bit far—the editing screen is sometimes occupied mostly by the top and bottom margins of your pages—but few programs are as simple and straightforward to use. If you're reading this magazine, you can probably manage a more difficult package, but if you live or work with someone who needs something simple, *Professional Write* is an obvious choice. If the rest of the office uses *WordPerfect*, however, the choice for the professional-class user should probably be WordPerfect Corp.'s new professional-and-laptop-level spinoff, *LetterPerfect*.

able then are still among the best available now, but for the first time since the advent of the PC, an entirely new class of word processors has emerged—the graphics-based programs, designed mostly for the *Microsoft Windows* environment, that let you create and edit text on a screen that directly represents the printed page. We evaluated five such packages last summer ("The Graphical Advantage: Tomorrow's Word Processors Today," *PC Magazine*, July 1990).

Like early character-based word processors hobbled by PCs with dual floppy disk drives and no hard disk, today's graphics-based programs are limited by the hardware on which they run. Although many functions of the best GUI word processors are impressively swift, as PC Labs' benchmark tests demonstrate, the simple task of entering and editing text still feels sluggish in these programs—even at 33 MHz with a fast video card. Printing, the one area in which you would expect graphics-based programs to excel, is actually where they lag behind. The best available printing, both in speed and flexibility, is offered by character-based *WordPerfect*—although the blame for the more limited printing in *Amí Professional* and *Microsoft Word for Windows* partly rests with *Microsoft Windows* itself and not those specific applications.

Word processors inspire fierce, often fanatical loyalty among their users, and once you've learned one, it isn't easy to recognize the merits of another. Devotees of *WordStar*'s control-key interface are baffled by *WordPerfect*'s function keys, and users of *Microsoft Word*'s cascade of alphabetical menus are puzzled by both. Now, however, the industry seems to be converging on a standard *Windows*-style interface of Alt-letter pull-down menus, each with first-letter shortcuts. Among character-based programs, *WordPerfect* and *WordStar* include such menus as an option, and *MultiMate* has similar menus; the next version of *Microsoft Word* will abandon the old *Word* interface for the emerging industry standard, although it will include disks with the older interface for those who don't want to switch.

FEATURE SETS

Choosing a word processor is more than a question of choosing among keyboard interfaces or between a graphics and a character-based program. Each of today's word processors includes a different set of conveniences that aren't directly related to word processing, and you can avoid hours of frustration by making sure the program you buy has the conveniences you need. Most advanced programs now include document summaries, file searching, and similar features needed in large offices. *WordPerfect* even lets you shield users from the DOS directory structure by creating long "aliases" for both directory and file names. *MultiMate*, *XyWrite*, and *Nota Bene* are among the few programs that can display a directory tree.

People who use word processors that let them open more than one file at a time feel claustrophobic if they're told to use a program that lets them open only one. Most advanced programs now open two windows, but the DOS version of *Microsoft Word* gives you eight, and *Word for Windows* gives you nine. *Amí Professional* also gives you nine, but at a greater cost in memory. All major word processors support outline numbering, but only *Microsoft Word*, *Word for Windows*, and Lotus's *Manuscript* offer full support for collapsible outlines that make it possible to build highly structured documents while looking at one or two screens.

Virtually all advanced word processors will let you restore text deleted earlier. *WordPerfect* keeps track of your last three deletions; *Amí Professional* optionally remembers four; the next version of *Nota Bene* will remember five. Most programs let you attach nonprinting comments to files on-screen the way you attach Post-it notes to documents on paper, and some give you the option of printing them.

WORD PROCESSORS: SUITABILITY TO TASK

PC Magazine assesses a word processing program's suitability in five areas—Personal, Professional, Corporate, Legal, and Desktop Publishing—and assigns a point value for each one. These subjective ratings, on a scale from 0 to 4, are presented along with each review, and translate as follows: 0—lacks feature or is not at all suited; 1—poorly suited; 2—some capability; 3—well-suited; 4—ideal for the task.

A **Personal** word processor should be very easy to learn and use; it is best suited for short documents, letters, and memos. Important features include context-sensitive help, simple menus, and clear documentation. The most common users are students, home users, executives, and other professionals who write short documents.

A **Professional** word processor is more full-featured. It should be able to handle long documents with extensive page formatting, including complex headers, footers, and indexing. Print control and dictionary support are also important, and likely users include professional and technical writers, students, and those working in the publishing industry.

Corporate word processors should easily handle short documents, letters, and repetitive memos that are produced often, and should offer mail-merge. Document summaries (including author, revisor, keywords) and envelope printing are musts. Parallel versions running on IBM and DEC mainframes and minis, or on Unix systems are a plus. Note that not all users within corporations are corporate users.

SUITABILITY TO TASK

Legal refers to the program's ability to provide the special functions and formats required by lawyers and law offices, including line numbering, redlining and revision marking, compilation of tables of authorities, file comparison, and password protection.

Word processors with **Desktop Publishing** features must be able to handle multiple columns of text, import common graphics files (.PCX, .CGM, TIFF) as well as *Lotus 1-2-3* and *Excel* spreadsheet data. They should also be capable front ends and partners for *Aldus PageMaker* and *Ventura Publisher*.

To receive a rating of 4, the product should provide all features that users expect now (based on competitive products) or will find on similar products in the near future (a DTP rating of 4 indicates a word processor with superior DTP features, but not a word processor equal to *PageMaker* or *Ventura Publisher*).

Surprisingly, not all word processors automatically keep track of where pages end or begin. All major programs can automatically break pages when you first enter text, but many forget to reformat when you add or remove text or when you change margins and fonts. *WordPerfect* and *Nota Bene* are virtually the only programs that are always ready to print the current page without making you type in its page number or reformatting first. *Microsoft Word* can repaginate in the background, but if you want the best possible speed from *Amí Professional* and *Word for Windows*, you have to work in an unformatted draft mode that pays no attention to page breaks at all. Worst of all in treatment of pages are *DisplayWrite* and *MultiMate*, which invariably need reformatting after extensive editing.

Other features to look for are annotations for group editing, redlining and strikeout to keep track of revisions, and links to spreadsheets and database files. Most programs now import graphics. However, you have to choose either full-featured graphics programs loosely integrated into the larger program, as an extensive subset of *Inset* is included in *MultiMate* and a lesser subset of the same program in *WordStar*, or less powerful but fully integrated graphics control, as in *WordPerfect*, or fully integrated and high-powered drawing tools as in *Amí Professional*.

PRESSING FOR BETTER PRINTING

Five years after the arrival of the desktop laser printer, some programs are still designed primarily for the fixed-pitch fonts of dot matrix and daisy wheel printers. *DisplayWrite* and *MultiMate* still have to perform special gyrations before they can print proportional text with line breaks where they belong. Most other programs now calculate correct line breaks as you type, but among character-based programs, only *Microsoft Word* and *Nota Bene* let you press a key or two to switch from a screen option that displays true line breaks—and forces you to scroll past the right edge of the screen to read a complete line—to an option that breaks the lines to fit the screen. Other programs make you change fonts if you want your text to fit the screen.

Even when virtually all laser printers support multiple character sets, only *WordPerfect* gives you a simple way to enter a copyright or trademark symbol into your file and be certain that it will print, no matter which font you choose. Of competing programs, *Nota Bene* is the only major program that has built-in support for foreign alphabets and foreign keyboards.

CONVERSION

No word processor is an island. The best-equipped programs come with conversion utilities to take in files from other packages, but *MultiMate* is one of the few programs that import directly and transparently. Most major word processing formats can now be imported directly into desktop publishing programs like *PageMaker* or *Ventura Publisher*, but if you buy a recently released word processor, it may take a few months for your DTP package to catch up.

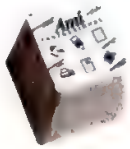
Some packages, notably *WordPerfect*, have given rise to small industries of add-on products. *Windows*-based word processors offer you the freedom to use other programs written for the same environment to perform tasks that can't be performed by the word processor itself.

REVIEW CRITERIA

These reviews cover the eight top-selling word processors in today's market, according to the latest available figures from Dataquest, a market research firm: Samna's *Amí Professional* (and its little brother, the original *Amí*), IBM's *DisplayWrite 5*, *Microsoft Word*, Ashton-Tate's *MultiMate*, Software Publishing's *Professional Write*, *WordPerfect*, and *WordStar*—as well as *Microsoft Word for Windows*, one of our Editor's Choices from the July 1990 evaluation (*Amí Pro* was the other). Six of these are full-featured professional word processors; the odd man out is *Professional Write*, an executive-level word processor with a smaller set of features designed for ease of use. The original *Amí* should also be counted among executive packages. If you look at the features table, you'll notice that *Professional Write* doesn't attempt to match the features of larger programs, but it isn't designed to, and its size and price mean that you should consider it separately. For a look at other popular packages and the word processing portions of three integrated packages, see the sidebar "Low-Cost Options for Easy Word Processing."

The best-sellers are not always the best performers. Three years ago, *PC Magazine*'s Editor's Choices went to *Microsoft Word*, *Nota Bene*, *Q&A Write*, *WordPerfect*, and *XyWrite*. The three not reviewed in this issue remain strong contenders. New versions of *Nota Bene* and *XyWrite* are due to appear by the end of this year or early in 1991 and will be reviewed in the First Looks section as soon as they arrive. Meanwhile, if you're in the market for a new word processor, one of the programs reviewed in this issue probably has most of the features and conveniences you're looking for, and provides them with an ease and speed you wouldn't have imagined possible a few years ago.

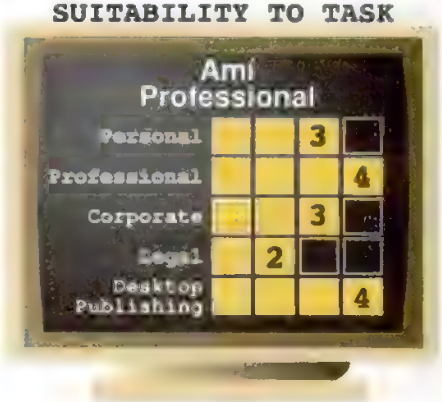
Amí Professional



If you want your word processor only to process words, *Amí Professional* will do the job. If you also want it to create and process virtually anything else, from tables to charts to drawings and imported graphics, Samna Corp.'s $495 graphics-based word processor can do that as well. With *Amí Professional* running smoothly under *Microsoft Windows* 3.0, you may find yourself using other software a lot less often, while enjoying your computer more.

If you don't need all the advanced tools in *Amí Professional*, you can buy the original *Amí*, now in a *Windows* 3.0–compatible version, for $199. It lets you edit the text in files created by its professional brother and displays and prints the charts, tables, and drawings or other advanced formatting in those files, although it doesn't let you edit those features. A frugal office can buy one or two copies of the *Professional* version and a dozen copies of the smaller version and share files without causing headaches. An ambitious office can use *Amí Professional*

SUITABILITY TO TASK



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under *New Wave* 3.0; *Amí* is the first major application that works with Hewlett-Packard's highly automated object-oriented environment.

The original *Amí* is refreshingly but unsurprisingly simple in performing basic tasks as well as difficult ones. If, for example, you want to create a chart, you can import data via the clipboard and let the program convert it into any of more than 50 charts—bar, line, pie, and other styles—complete with multicolor and 3-D options. And if you need to type in your data by hand, you don't have to struggle your way around a menu: You simply open a special blank window, enter headings and data as if you were typing on a typewriter, close the window, and see your chart emerge in seconds.

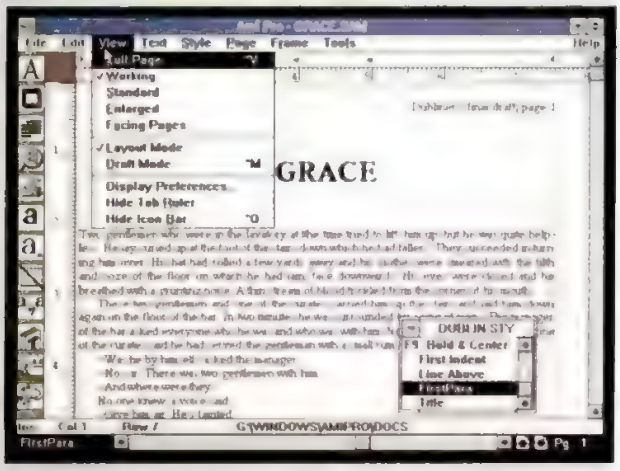
When you want to create a running head, you don't have to hunt for the header menu. You merely move the cursor into the top margin of the page and start typing. You can modify the format of the header using the same straightforward format and stylesheet menus that you use for any other text.

You can easily create "floating headers" that appear only on the pages that contain text you associate with the headers. When you create a footnote, the cursor jumps to the foot of the page and you start typing the note exactly where it belongs.

ONE-STEP MENU SCHEME

When you want to format text or modify a stylesheet, you don't have to march up and down the maze of multilevel menus offered by the other leading *Windows* word processor, *Microsoft Word for Windows*. Instead, you open a single, almost full-screen menu that covers most major options for font and format and has a series of buttons that take you immediately to less-common options like lines above and below, bullets, and numbering styles. Each submenu displays the list of styles and the list of other available panels in the menu. For instance, you can modify bullets in all the styles in a stylesheet without changing menus, or change one style's font and border lines without going back to the top menu. *Word for Windows* feels labyrinthine by comparison.

On the other hand, *Word for Windows* conveniently lets you create a style by directly formatting a paragraph in your document, and then assigning a name to the resulting style; *Amí* doesn't. You must create or modify styles in the style menus, while the program displays the effect of your choices in a small window showing samples of type or thumbnail drawings of paragraphs or pages. This means you may spend time experimenting with directly formatting text and then reproducing the format step by step in the style menus. *Amí Professional* also has some annoying time-wasters, like a screen that indicates how many times it replaced a string in search-and-replace—a screen you have to remove before you can continue working.



***Amí Professional* lets you view the screen virtually any way you want. As shown here, you can have vertical and horizontal rulers, a customizable icon bar, and a list of style tags. You can also display paragraph markers and other codes.**

INTELLIGENT FRAMES

Amí Professional sometimes resembles a desktop publishing program more than a word processor, even though it includes a full set of advanced word processing functions. If you want to use columns, insert a graphic, or create a sidebar, chart, or drawing, you first open a frame, as you do in *Ventura Publisher*. You don't have to typecast a frame in advance as a container for graphics or text. If you move the cursor into the frame, double-click the mouse, and start typing, the frame becomes a text frame. If you select the drawing or charting tools, or the menu that imports graphics, the program needs no further prompting to figure out what you want.

Frames have their strong and weak points. Once you create a frame, you can anchor it to its position on the page or let it float with the paragraph above, wrap text on either side, or make it transparent or opaque to the text or frame below. You can repeat a frame and its contents on any page, but you can't flow text from one frame to another. However, a frame's size remains constant until you explicitly change it; it won't automatically expand when the text inside fills the original dimensions.

You can create tables either directly in your text or segregated in a frame and use them for five-function arithmetic and simple formulas. A quick-add function immediately gives the total for a row or column without making you enter a formula. Table cells, unlike frames, will expand to accept additional text, but if the table is in a frame, the cells can't expand

FACT FILE
EDITOR'S CHOICE

Amí Professional,
Version 1.2
Samna Corp., 5600 Glenridge Dr., #300, Atlanta, GA 30342; (404) 851-0007.
List Price: $495; *Amí*, $199.
Requires: 640K RAM, DOS 3.0 or later. Mouse recommended.
(Ships with runtime version of *Microsoft Windows*, but the full version of *Windows* is recommended.)
In Short: *Amí Professional* combines strong word processing functions with surprisingly strong charting and drawing functions. This is the one *Windows* application that provides tools for creating virtually any part of a document (including mail-merge) without turning to other programs—and, as a bonus, provides tools that are simple. *Amí Professional* is not as strong as *Word for Windows*, but it has dozens of graphics functions that *Word for Windows* lacks entirely. The new *Windows* 3.0–compatible version of *Amí Professional*'s little brother, *Amí*, can print and edit any *Amí Professional* file, although it lacks the tools for creating or editing drawings, charts, and tables. It's not in the corporate word processor class, but *Amí* lets you create impressively complex formats with ease.

CIRCLE 401 ON READER SERVICE CARD

In Atlanta, Georgia...

You'll find magnolia trees, mockingbirds and Olympics fervor as the city gears up for hosting the 1996 games. In Marietta, a suburb of Atlanta, you'll find ZSoft Corporation and Gateway 2000 computers.

ZSoft, the well-known graphics software company that created PC Paintbrush™, often

ZSoft employees Dave Steier, left, and Don Womick, Jr., with Don's Gateway 2000 20 MHz 386 system.

demonstrates its software at trade shows on Gateway 2000 computers. Dave Steier, ZSoft code librarian and software demonstrator, said he prefers showing products on Gateway systems. "They're terrific," Dave remarked. "I just got back from a show where I was using Gateway 33's and they're screamers."

Don Womick, Jr., a programmer for ZSoft, bought a Gateway 2000 20 MHz 386 for his personal use because he liked the Gateway systems at work. "With Gateway," said Don, "I was able to get the performance I need at a price I could afford."

Don and Dave both commented on the excellent service they received from Gateway. "I've dealt with lots of Gateway people," Dave commented, "and everyone is uniformly polite,

And at the Grand Canyon in Arizona...

You'll find indescribable beauty and serenity – or exhilaration if you see the canyon on a tour from Papillon Grand Canyon Helicopters, where Gateway 2000 computers are used in the operation of the canyon's premier flight service.

Rick Carrick, chief pilot, started using PC's a few years ago to run point-of-sale software and to perform weight and balance calculations on aircraft, a critical safety and efficiency procedure. Initially he experimented with several computer firms. "I called Gateway because I liked their ads," Rick admitted. "But I've become a loyal customer because their machines are indestructible and they have excellent customer service."

Rick Carrick, Papillon Grand Canyon Helicopters, and his indestructible Gateway 2000 286.

Rick's first Gateway 2000 system was a 286 model. "This machine runs flawlessly after about a year of continuous operation in a dusty office that's constantly vibrating because of the aircraft outside," commented Rick.

Papillon Helicopters has another Gateway computer now – a 25 MHz 386 – and Rick said he's in the process of replacing all of the company's PC's with Gateway 2000 systems.

Conservationist John Muir said, "...the Grand Canyon will seem as novel to you, as unearthly in the color and grandeur of its architecture as if you had found it after death, on some other star."

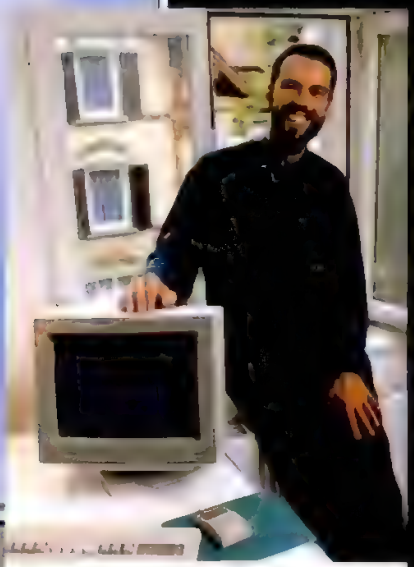
GATEWAY2000

waser

In Zurich, Switzerland...

You'll find the famous Swiss watch makers, luscious chocolates, international banks on every corner and Gateway 2000 computers.

Michael Paravicini, a management consultant for Price Waterhouse in Zurich, uses a Gateway 2000 33 MHz 386 system to run project management and business graphics software.



Michael Paravicini, Price Waterhouse, and his Gateway 2000 33 MHz 386 system.

Michael said he heard about Gateway through the PC magazine reviews and ads. "I was impressed by Gateway's price-features comparison," Michael remembered. "My system cost far less than you'd expect to pay for a comparable computer." Continuing, he said, "It was also the responsiveness they showed when I sent a fax request for a quotation. Out of ten U. S. companies I contacted, Gateway was the most prompt and efficient in responding. I still haven't heard from some of the others."

Asked if he had any problems with the system or with purchasing from a U. S. company, Michael said no. "I was satisfied with the entire transaction," he commented. Although many Europeans, like Michael, are comfortable doing business in English, Gateway 2000 also has sales representatives who speak French and Spanish.

Switzerland is celebrating its 700th birthday, which explains why Zurich abounds in classic architecture and old-world charm.

GATEWAY2000

In Lake Elsinore, California...

You'll find rodeos, vineyards, hang gliders, the Palomar Observatory and a remarkable 11-year-old boy called "C.J." with his Gateway 2000 computer.

Of course the Gateway computer, a 386SX, really belongs to C.J.'s parents, Craig and Janet Little. Janet bought the system for her business, Bright Beginnings, a service to welcome newcomers to Lake Elsinore. But, as she explained, "C.J. took over the computer." So it was C.J. who called for help when he got a BIOS error message. Gateway's tech support rep diagnosed the hardware problem, sent a replacement part and guided C.J. through the installation over the phone. "It wasn't that hard," said C.J. "The guy I talked to was really helpful."

C.J. Little and his family's Gateway 2000 386SX.

The Littles chose Gateway 2000 on the recommendation of a relative. "My uncle has a degree in computer science," C.J. commented, "and he told us that Gateway was the best value on the market."

But C.J. and Janet agreed that what impresses them the most about Gateway is the service department. Janet said, "I think when people are spending a lot of money on a computer, service is very important. And we were pleased with the way Gateway handled our problem."

Lake Elsinore, known by Indians as "Hot Springs by the Little Sea," is a popular southern California location for hang gliding.

GATEWAY2000

And in Fayetteville, Arkansas...

You'll find a delightful little city, surrounded by the Arkansas Ozarks, with miles and miles of rolling green hills, clear lakes and rustic farms. You'll also find a large farmers' market in the town square, Betty's Word Processing and Gateway 2000 computers.

Betty and Bill Carson, owners of Betty's Word Processing, and their Gateway 2000 386SX.

Betty Carson and her husband Bill own and operate Betty's Word Processing. The couple uses a Gateway 2000 386SX to run word processing, spread sheet and genealogy software. (Betty has traced her family back to 1649!) Betty and Bill picked Gateway 2000 after a lot of study.

"Bill reads all the computer magazines," Betty remarked, "and he's convinced Gateway has the best quality hardware around – and a great price."

"We've used several different computers," added Bill, whose hobby is electronics, "including an Apple and an IBM. But we like our Gateway the best."

Betty said she was most appreciative of

People the World Over

Everywhere you look these days you'll find Gateway 2000 computers. That's because people everywhere know a good value when they see one. In all 50 states and in over 70 foreign countries, thousands of people are comparing price, quality and service – and choosing Gateway 2000. Compare for yourself.

Price

Examine the last page of this ad, where you'll find a concise listing of Gateway 2000's product line, and compare Gateway's features and prices with any other computer manufacturer. Many competitors try to trick you with low prices on stripped-down systems. Others copy Gateway's features and prices but don't tell you they're using fishy components and building their systems in the back of their brother-in-law's bait shop. When you've had enough of the confusion, call Gateway for some straight talk from a knowledgeable sales person. In a direct comparison, Gateway has the best prices.

Quality

Don't let Gateway's low prices deceive you about quality. Only the highest quality components go into a Gateway 2000 computer. Each system is custom-built with pride by one of Gateway's Midwest technicians. As the reviews indicate, the quality of a Gateway 2000 system is comparable to the best PC's on the market.

"The combination of price, quality and service makes Gateway 2000 the best value in the industry."

"They're terrific. I just got back from a show where I was using Gateway's 33's and they're screamers." Dave Steier

"Bill reads all the computer magazines and he's convinced Gateway has the best quality hardware around." Betty Carson

Service

Of all the factors to consider when selecting a computer, service is perhaps the most important and the most difficult to judge. When customers talk about Gateway 2000, they invariably mention service.

"What impressed me most about Gateway was the service. The guy I talked to was really helpful." C. J. Little

"Everyone is uniformly polite, friendly and helpful." Dave Steier

PC Magazine's September 25 issue included the results of a survey about service and reliability that confirm what these Gateway 2000 customers are saying:

Choose Gateway 2000!

"Gateway shared top billing with such heavyweights as Compaq, IBM, and HP for those who would buy their products again...Overall, Gateway's high marks bode well for the company's future, as does its commitment to customer service."

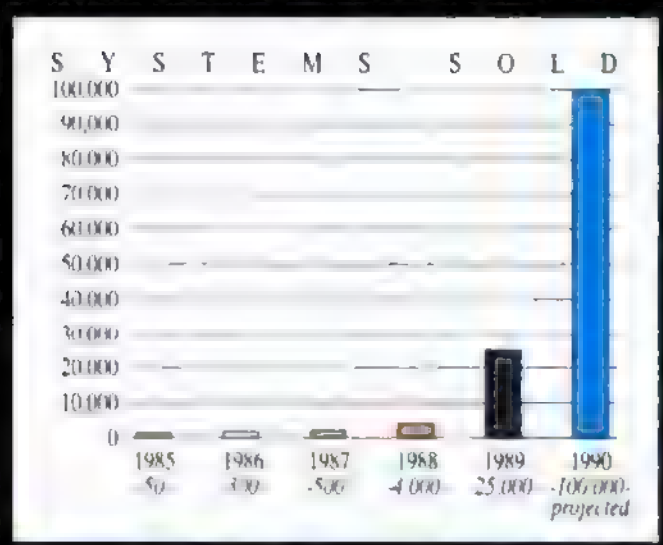
PC Magazine
September 25, 1990

"In the computer industry, longevity should be measured in dog years."

Success

The combination of price, quality and service makes Gateway 2000 the best value in the industry. But value alone doesn't explain how a little company in the Midwest, just celebrating its fifth anniversary, managed to outdistance hundreds of other companies, selling more systems through the direct market channel than any other PC manufacturer in the country.

"It was the cows," laughed Ted Waitt, Gateway 2000 President and CEO. "Of course." Computer magazine readers will remember that the company's early ads featured a picture of the Waitt family cattle farm with the headline, "Computers from Iowa?"



Gateway 2000 sells more computers through the direct market channel than any other PC manufacturer in the country.

"We can't run that ad anymore," continued Ted, grinning, "because we built a new plant 14 miles down the road in South Dakota. But the cows really worked for us. They made the phones ring. From then on, though, we built our business on value – good prices on quality systems with old-fashioned, personal service."

Ted mentioned another reason for Gateway's success. "We take a long-term approach to customer service," he said. "When you buy a computer from Gateway 2000, you become part of our family and we're going to be there for you as long as you own that machine."

As Ted talked about the company's fifth anniversary, he laughed again. "In the computer industry, longevity should be measured in dog years," he chuckled, "because everything's moving so fast. That makes Gateway 35 years old! But seriously, we've come a long way in five years. And I owe it all to the great people at Gateway and to our customers."

Dial the Phone

Gateway 2000 will be there for you 'til the cows come home.

When you add it all up, you'll understand why people the world over choose Gateway 2000. So pick up the phone and dial. Whether you're from Washington or Sweden, Connecticut or Canada, you've got a friend in the business at Gateway 2000.

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"You've got a friend in the business."

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beyond the frame border. When you enter data in a table, the program optionally displays letters at the heads of columns and numbers at the left side of rows, but these disappear when you move the cursor outside the table or when you print. Tables, graphics, and text can be hot-linked to other *Windows* applications via Dynamic Data Exchange (DDE).

WAITING FOR WYSIWYG

Ami Professional works reasonably quickly under *Windows* 3.0, but, like *Word*

LOW-COST OPTIONS FOR EASY WORD PROCESSING

by Ed Perratore

With full-featured word processing, you can't lose by heading straight to the top and using *WordPerfect*, *Microsoft Word*, or any other professional-level package. But beyond the din of power users who clamor for more functionality, there exists a less vocal crowd that will gladly settle for less word processing power at a more reasonable price. If you're part of this group, there are plenty of packages to choose from.

These low- to midrange word processors maintain their market niches by addressing users who are convinced they'd never use high-end features, and by opting for less you may actually end up with more. How? If your word processing requirements are modest, you can use one of the many low-end integrated packages available today: *Microsoft Works*, Lotus Development's *Lotus Works* (formerly *AlphaWorks*), or Software Publishing Corp.'s *PFS:First Choice*. (*Microsoft Works* and *AlphaWorks* were Editor's Choices when we last looked at low-end integrated packages in our December 26, 1989, article "Integrated Software Gets It Together.") Packages like these have all the word-processing functionality that many users will ever need, and include databases, spreadsheets, graphing, communications, and desktop utilities as well.

These programs, along with two midrange word processors, Symantec's *Q&A Write* and QuickSoft's popular *PC-Write*, generally skimp in places you won't mind. They can be installed on a 3.5-inch floppy disk for laptop use (where integrated packages are especially popular), and can import/export ASCII text from and to high-end programs if you opt to upgrade later. You should scrutinize each package to see what is and what isn't included, because with careful research you can't lose.

LOTUS WORKS

Alpha Software's *AlphaWorks*, sold to Lotus Development Corp. and renamed *Lotus Works*, packs a lot into a $195 integrated package. Its word processing module is no exception. You can work on nine files at once and switch between two displayed windows with a hotkey.

Once you enter a "Words service," you can begin typing immediately or retrieve a file using a pull-down menu. Text formatting options are versatile for an integrated word processor. You can select from eight ruler settings that include line spacing (whole lines only), tabs, and left and right margins that can be placed anywhere in your document as often as you need. Text can also be indented, although special formatting such as hanging indents and spacing other than single, double, and triple are not available.

While it won't accept downloadable fonts, *Lotus Works* can make use of whatever resident fonts or enhancements your dot matrix or laser printer offers. Using the Epson printer driver, the program comes up with normal, italic, bold, bold italic, and super- and subscripts. You can edit the driver from the Words service or add escape codes through the AWCONFIG.EXE program.

You can block by word, sentence, line, or paragraph, or point-to-point, but not backward from your starting point. You won't see italicized text on-screen; screen fonts are a high-end feature you won't see in any of these programs. *Lotus Works* displays all enhancements as different colors you set in AWCONFIG.EXE.

There's plenty more in *Lotus Works*, including keyboard macros, intuitive Ctrl-key shortcuts, a 100,000-word spell-checker with flexible options, mail-merge, context-sensitive help, and data import from the database and spreadsheet modules. For the price, it's a winner.

MICROSOFT WORKS

Microsoft Corp. is confident about *Microsoft Works*, its *Windows*-oriented integrated package, which is a steal at $149. Frequent bundling arrangements with PS/2s and other vendors' PCs, plus a wealth of features that include on-line tutorials, make the product a real contender in the home and small-business PC market.

Mouse- or keyboard-driven pull-down menus with hotkeys and dialog boxes, familiar to any *Microsoft Windows* user, are augmented by an assortment of Ctrl-key combinations. For the most part, they're easy to remember, and they help in text formatting and cursor positioning. All fonts and type enhancements available from your printer can be selected through the Format menu. Hitting Ctrl-Space shuts off the enhancement.

Search-and-replace functions in *Works* help you find both text strings and formatting characters like tabs and hard carriage returns, but not fonts or enhancements. This capability places the program between *PFS:First Choice* and *Q&A Write*. You can set line spacing in inches or centimeters, a refreshing switch from the typical single or double spacing in most low-end word processors. Special characters such as nonbreaking hyphens and spaces, date, time, and filename can be inserted into documents as well. Smooth mail-merge from the database module lets you print form letters and mailing labels. Other handy features include the insertion of spreadsheets and graphs, an undo function, macros, a calculator, special formatting, and the ability to display eight files on the screen at once.

File conversion, largely through ASCII or IBM DCA format, includes import/export from and to *Microsoft Word*. Packages such as *PFS:First Choice* offer more options here, but *Microsoft Works* remains an excellent integrated choice with a versatile word processor as one component.

CONTINUES

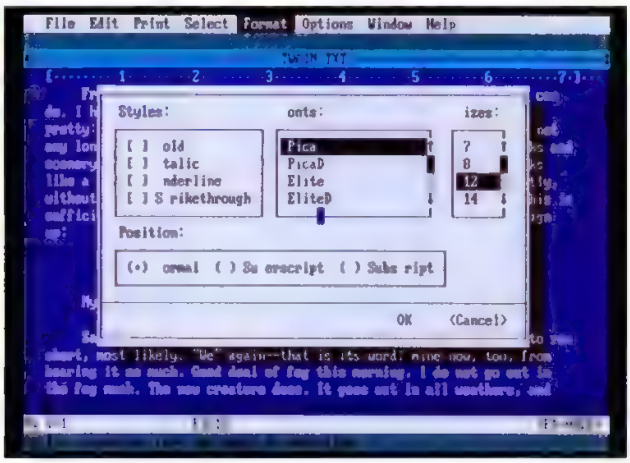
for Windows, it will need the next generation of hardware (or the generation after that) before its full WYSIWYG mode feels as sleek as the best character-based programs. You can enter text quickly in an optional draft mode, and you can tell the program to switch automatically into draft mode when spell-checking or performing a search or replace. Draft mode has its limitations, however. If you use multicolumn text or sidebars, you can't see the text on the same draft-mode screen with the main text of the file, and you can't even see where the multicolumn text fits into the rest of the text. You need to switch to layout mode, move the cursor into the frame with the columns or sidebar, and then switch back to draft mode to see sidebar or column text. But you can make

LOW-COST OPTIONS

CONTINUED

PC-WRITE

Among the programs discussed here, Quicksoft's *PC-Write* holds the distinction of being the most powerful as well as the least expensive at $129. But there's a catch: This word processing package presents a formidable challenge for those users who wish to tap all it has to offer.



The Font & Style choice in *Microsoft Works* Format submenu invokes this dialog box, showing options available for your installed printer.

PC-Write requires plenty of homework before you can do more than save, retrieve, or print a file. (An update, due out next summer, will feature pull-down menus, mouse support, and a thesaurus.) The package uses virtually every imaginable combination of Ctrl, Alt, Shift, and function keys plus several Ctrl-letter commands. The top line of your working screen is reserved for a program and file status line; the next two display Lotus-style menu/submenu choices and either a ruler line or a terse explanation of the menu choice you've highlighted.

General editing is a bit awkward because of the program's break from standard keys many of us have come to expect in a word processor. F1 summons help, but Scroll Lock toggles from Overstrike to Insert modes, and you hit both F1 and F3 to save a file. However, you can redefine the program's keys to your heart's content.

If your printer supports them, drivers for more than 700 models are included, and you can use up to 22 fonts per document. *PC-Write* also features macros, undelete, search-and-replace, mail-merge, spell-checking, automatic saves, versatile column creation and editing, and box drawing. Some of the program's more-innovative features include character transposing for the fumble-fingered, a Repeat Last Keystroke command, and a Shorthand feature that lets you type in an abbreviation for commonly used words. More than 45 customizable help screens on a variety of topics will help you through all these options.

There's a wealth of quiet power in *PC-Write*, enough even for many power users, but like many higher-end packages, it requires a learning investment on your part.

PFS:FIRST CHOICE

You get a taste of many features in Software Publishing Corp.'s $159 *PFS:First Choice*, and if your needs are modest, you may never go away hungry. *First Choice*'s word processing module offers less functionality overall than the other two integrated packages reviewed here and certainly less than *Q&A Write* and *PC-Write*. Don't write off this easy-to-use program, though; the market leader of integrated programs has much to offer the word processing beginner or light user.

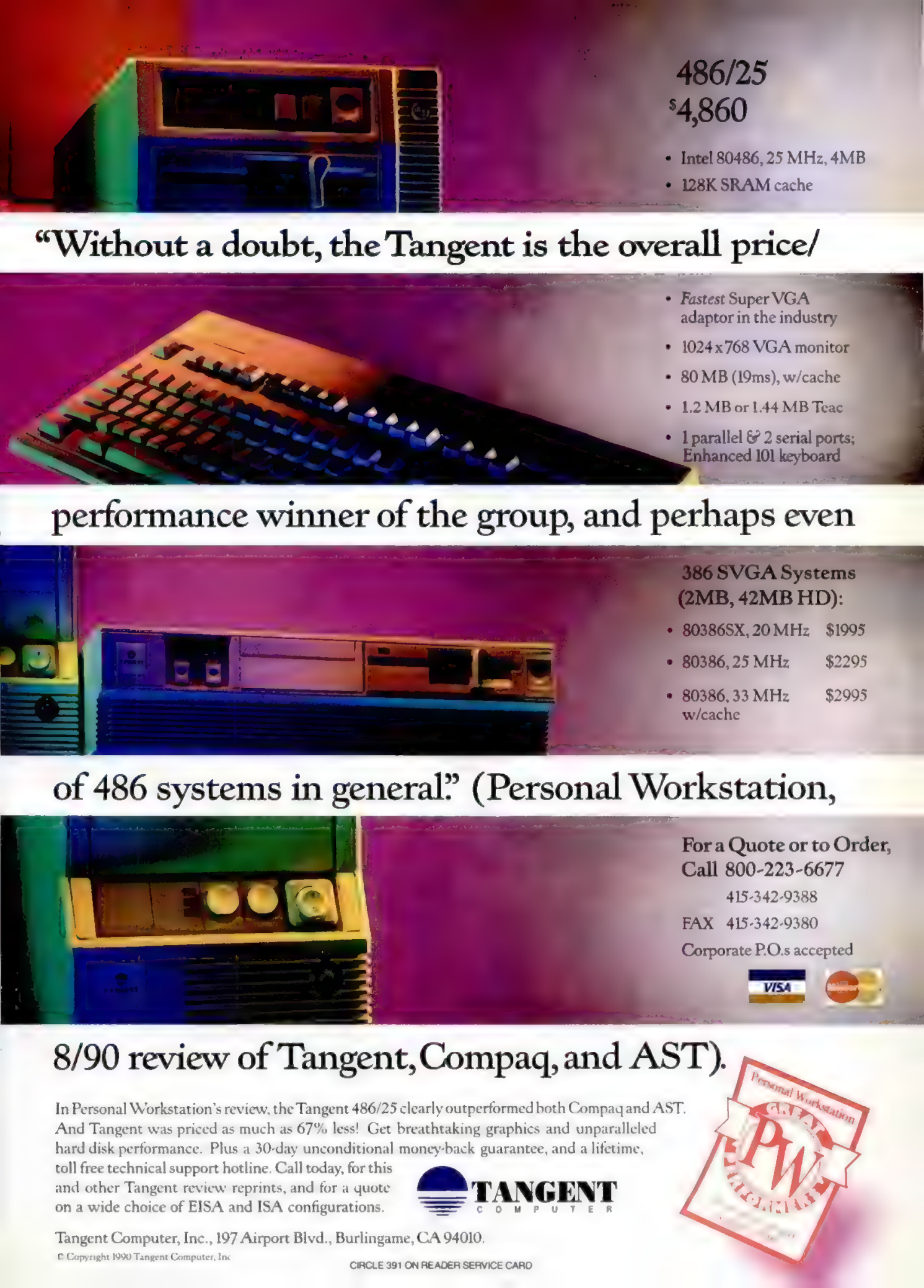
First Choice's working screen resembles a piece of paper with a thin border surrounding your text and space skipped to where printing begins about halfway down the screen. Your working area is also filled with spaces even before you enter text (an approach shared by *Q&A Write* and *PC-Write*), which can be annoying if you're accustomed to quick cursor travel around the screen.

You can work on only one file at a time in *First Choice*, but the clipboard function lets you cut and paste to other modules. Formatting, accomplished through either hotkeys or the pull-down menus (keyboard- or mouse-controlled) seems sparse at first but is adequate.

All enhanced text is highlighted in the same color, which makes for some tricky editing. You can double up on formatting the same block of text by separately adding both bold and italics for bold italics. You can also set enhancements and fonts by sending control codes to your dot matrix or laser printer.

PFS:First Choice offers a no-frills search-and-replace function, and the spell-checker is fine for most tasks. You can also use personal dictionaries of up to 2,000 words. File conversion to and from *Microsoft Word* (Version 3 only), *WordPerfect* (4.1 and 4.2), and other text-only word processors comes in handy. Text and

CONTINUES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spelling and searching operate automatically in all text, in frames or out.

In WYSIWYG or layout mode, the program optionally hyphenates as you type (using an algorithm that you can override with your own choices). As you type, you see the top and side margins of a page, but not the top of one page and foot of another at the same time. Layout mode gives you a choice: zoomed-in view of the page; a "standard" view (similar to those in other *Windows* applications) that will probably force you to use the horizontal scroll bars to edit a full line; a working view that displays the full width of text on the page and can be customized for the exact degree of reduction you need; a reduced full-page view; or an uneditable view of facing pages.

LOW-COST OPTIONS

CONTINUED

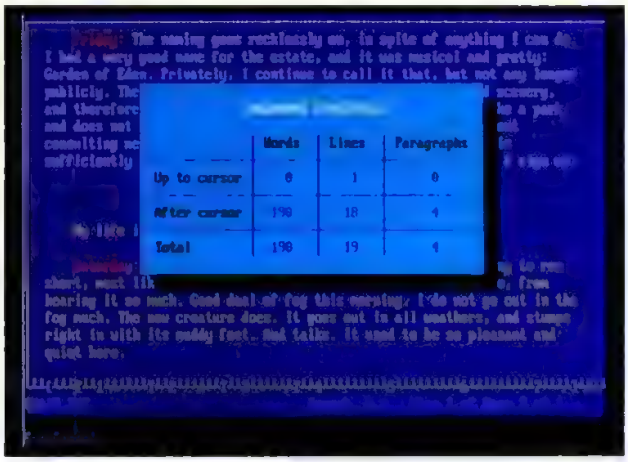
command macros, mail-merge (using the database), and quick block operations add to the options of this program's limited but capable word processing module. PostScript support is a major enhancement in Version 3.1, priced at $169 and scheduled to have shipped this fall.

Q&A WRITE

The standalone, enhanced version of *Q&A*'s word processing module, *Q&A Write* 1.01 from Symantec Corp., provides plenty of functionality for $199. Smooth integration with *Lotus 1-2-3*, font and laser printer (including PostScript) support, and impressive mail-merge capabilities are only part of the picture.

Q&A Write does a good job of addressing the new user while keeping more-experienced users happy and productive. The only exception is the page-like, space-filled screen, similar to that of *PFS:First Choice*, which starts a file and is designed to keep new users comfortable. First, you're offered the default directory to call up a file, but you can edit right over it to get to the path and/or file you want.

It is in its function-key selections that *Q&A Write* is unlike the majority of low-end word processors. The program allows up to nine font assignments, plus any combination of enhancements your printer will allow. It permits some of the most sophisticated search-and-replace parameters you'll see. ("T.. e.." refers to two consecutive words, the first beginning with "T," the second with "e," as in "The end.") It additionally features integrated card files allowing up to 1,000 entries that can be mail-merged into documents, line drawing, columns (up to eight per document), Intel EMS AboveBoard support, import/export of *Lotus 1-2-3* and ASCII files (including print-time inclusion of graphs), and embedded printer-control strings.



The Document Statistics report in Symantec's *Q&A Write* comes in particularly useful for anyone writing to a particular specification.

However, you won't find a thesaurus (a $49.95 option) or full word processing conversion in *Q&A Write*. The latter comes in the form of the $29.95 Document Conversion Utility and offers direct import from *Microsoft Word*, *WordPerfect*, *XyWrite*, *MultiMate*, and several other word processors. Apparently, Symantec is counting on users to find the program a bargain even without these extras. For the most part, you'll agree.

***Lotus Works*, Version 2.0**
Lotus Development Corp., 55 Cambridge Pkwy., Cambridge, MA 02142; (617) 577-8500.
List Price: $195.
Requires: 512K RAM, DOS 2.0 or later.

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***Microsoft Works*, Version 2.00**
Microsoft Corp., 1 Microsoft Way, Redmond, WA 98052-6399; (206) 882-8080.
List Price: $149.
Requires: 512K RAM, DOS 2.0 or later (for network use, DOS 3.1 or later).

CIRCLE 414 ON READER SERVICE CARD

***PC-Write*, Version 3.03**
Quicksoft Inc., 219 First Ave. N, #224, Seattle, WA 98109; (206) 282-0452.
List Price: $129.
Requires: 448K RAM (320K without spell-checker), DOS 2.0 or later.

CIRCLE 415 ON READER SERVICE CARD

***PFS:First Choice*, Version 3.02**
Software Publishing Corp., 1901 Landings Dr., P.O. Box 7210, Mountain View, CA 94039; (415) 962-8910.
List Price: $159.
Requires: 512K RAM, DOS 2.0 or later (640K and DOS 3.1 or later for network version).

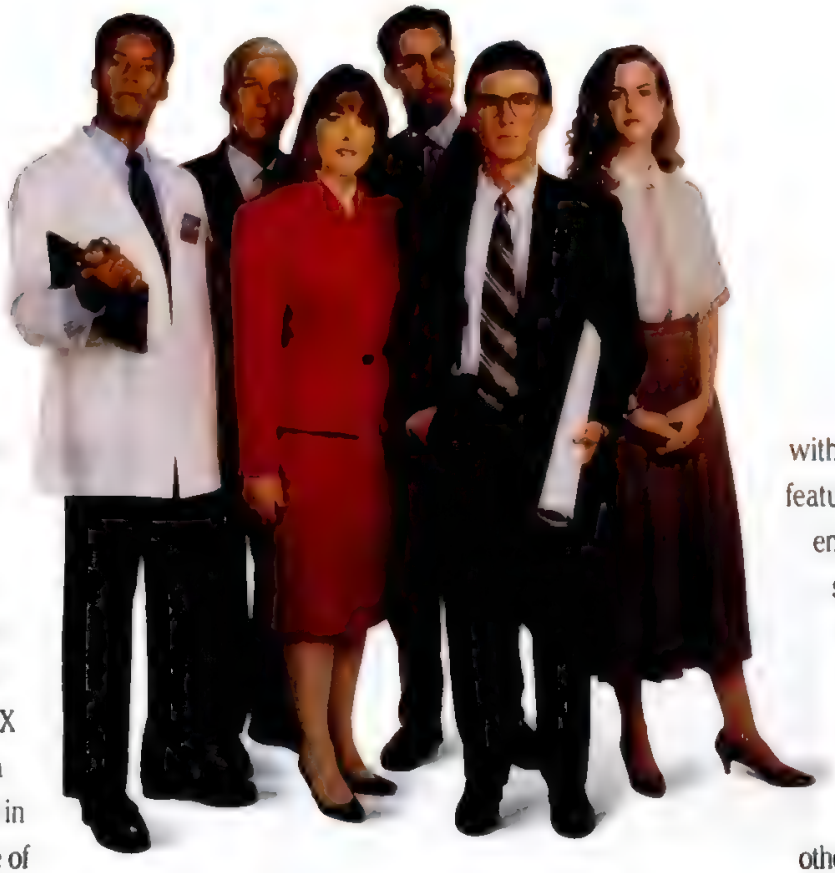
CIRCLE 416 ON READER SERVICE CARD

***Q&A Write*, Version 1.01**
Symantec Corp., 10201 Torre Ave., Cupertino, CA 95014-2132; (408) 253-9600.
List Price: $199; thesaurus, $49.95; Document Conversion Utility, $29.95.
Requires: 384K RAM (with DOS 3.2 or later, 448K; for network use, 512K); DOS 2.0 or later (for PS/2 use, DOS 3.3). 512K RAM recommended.

CIRCLE 417 ON READER SERVICE CARD

Ed Perratore is a frequent contributor to and former associate editor of PC Magazine. ■

What does Compaq give 386 users who expect the moon?



Giving demanding users the best PC possible is a tradition at Compaq. A tradition we upheld when we introduced the world's first PCs based on Intel's 386 and 386SX microprocessors. And a tradition that continues in our comprehensive line of desktop PCs.

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Come look at the COMPAQ DESKPRO 386N Personal Computer, for example. It's a full-function PC with breakthrough features for networked environments. As a stand-alone PC, its 16-MHz 386SX microprocessor handles all of the general business applications our other 386SX-based PCs run. With so many integrated features, you can take care of your expansion needs using only two slots.

And it comes with a host of unique network features like multilevel security, making it the best full-function PC for connected environments. All of this fits neatly into a space-saving design.

The COMPAQ DESKPRO 386S Personal Computer is also designed to handle general business applications. Its 16-MHz 386SX microprocessor gives you exceptional 386 performance. And its 32-bit architecture lets you run today's popular business software. It also offers the flexibility to run tomorrow's advanced business software.

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The stars.

Project managers and other general business users will find everything they need to manage databases and speed through complex spreadsheets in the COMPAQ DESKPRO 386s/20 Personal Computer. It delivers the maximum in 20-MHz 386SX performance and a broad range of integrated features.

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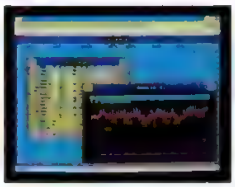
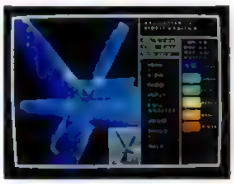
It's the perfect personal computer for people who are serious number crunchers, administrators who manage massive loads of information and engineers who work on generating complex two-dimensional CAD drawings.



At the most demanding level of 386 computing are the power users who do graphic-intensive applications like 3-D CAD drawings and other performance-intensive applications. These people need the kind of high performance that the COMPAQ DESKPRO 386/33L Personal Computer delivers. It combines the fastest 386 chip with high-performance innovations. And it lets you easily upgrade to the power and performance of a 486 chip.



If you're looking for the 386 desktop PC that simply works better for whatever you do, call 1-800-231-0900, Operator 129. In Canada, call 1-800-263-5868, Operator 129.

COMPAQ

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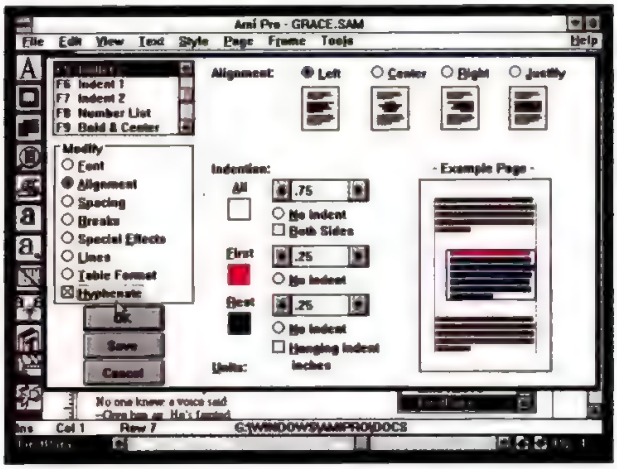
In any of these views, you can choose to display paragraph marks, column guidelines, pictures, and nonprinting comments (with date and time of creation), plus a tab ruler and status bar. Few other programs give you so rich a choice of viewing options. *Amí Professional* is notably awkward, however, when you want to keep two files open at the same time. The program actually opens another copy of itself when you open another file, a procedure that wastes memory and slows you down when you switch among open documents.



When you modify a stylesheet in *Amí Professional*, you can change all elements of the style, such as font, alignment, and spacing, from a single menu by choosing the different window "panes" listed in the middle. You can also change elements for all styles without exiting the pane.

The most spectacular viewing option of all is a customizable icon bar that holds up to 12 symbols that represent various formatting and editing options you can perform by clicking on the icon. You can include the kind of symbols for bold or italic included in *Word for Windows*' ribbon, or you can switch view modes, run the spell-checker, or even assign your own macros to icons.

MACRO POWER

Those macros can be enormously complex, including some features not included in *Word for Windows*' generally more extensive macro language. A macro manual is included in the help system, and a printed manual is free for the asking. Some functions that *Word for Windows* makes you perform with a macro are built into *Amí Professional*. For example, *Amí Professional* can automatically remove paragraph markers at the ends of lines in imported ASCII text. You're lucky it can do this, because the search function has a strange bug that makes it unable to search for two adjacent paragraph markers, an ability you would need if you wanted to accomplish this with a macro.

Amí Professional's drawing and charting tools don't equal those in standalone programs, but they're surprisingly powerful. Charts consist of objects, which you can move and modify using the drawing tools to gain total flexibility in placing legends, adding text, or exploding sections of a pie chart. The drawing tools let you create a variety of lines, polygons, or parabolic arcs, but you can't simply move the cursor for freehand drawing. If you import vector graphics, you can modify them with the drawing tools, and an impressive image enhancer lets you adjust the contrast, smoothness, and edges of gray-scale TIFF images.

Compared with *Word for Windows*, *Amí Professional* is less well suited to long files and the kind of automated document-building made possible by *Word for Windows*' fields. But if you want a single program that combines much of the graphic flash of desktop publishing programs with the flexibility of character-based word processors, your best choice is *Amí Professional*.

DisplayWrite 5

If you ever need proof that IBM has an uncanny and apparently unbreakable hold over the hearts and minds of hundreds of thousands of computer users, just spend a few weeks working with *DisplayWrite 5*. IBM's $495 word processor for DOS (a non-Presentation Manager version is available for OS/2) is one of the more amazing programs on the market—amazing not because of its features or interface, but because so many people still use it when a phone call to a mail-order house would bring them an alternative.

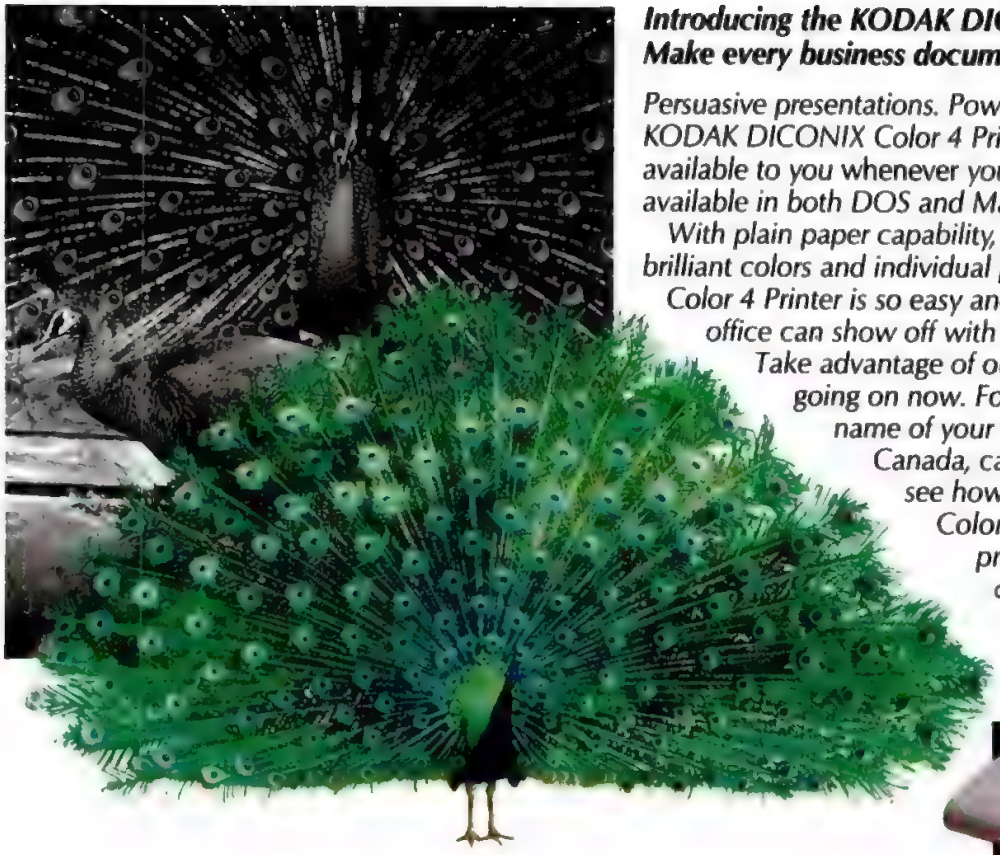
For some users, perhaps, *DisplayWrite*'s unique features make it the only program that suits their needs. If your computer has IBM's Voice Communications Adapter board installed, *DisplayWrite* lets you attach spoken annotations to its files and play them back with two keystrokes. *DisplayWrite* can be set to save files automatically in the RFT format, which allows easy interchange with versions of *DisplayWrite* used by IBM mainframes.

SUITABILITY TO TASK

Display Write supports menu-driven mail-merge using *Lotus 1-2-3* or *dBASE* files, and even lets you program the resulting merge from a menu—a feature rarely found elsewhere. It can be told to print snaking columns in evenly balanced lengths. It supports footnote libraries, which let you store notes that you want to use in more than one document—a feature that looks attractive until you realize that other programs' glossaries and macro libraries do the same thing with fewer keystrokes and without making you dig up a printout to figure out how to access the note you want to reuse.

DUAL INTERFACE

Once thoroughly menu-driven, *DisplayWrite* now lets you use two interfaces at once. You can access menus via function keys and Alt-Ctrl key combinations. Or you can press Ctrl-A to open a *XyWrite*-like command line and enter abbreviated commands. Some of these commands use obscure abbreviations, like LOT to mark the position of a table of contents, or DEN



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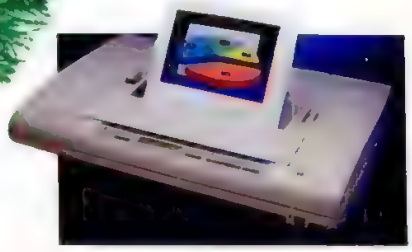

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for Line Density, meaning the height of a line of type measured in points, but they save you from a lot of menu jumping.

The function-key interface has comparable obscurities. A list of keys at the top of the screen tells you to use F5 for "Functions" and F8 for "Instructions" but doesn't tell you how to figure out which commands fit arbitrarily under particular categories. If you bring up the wrong menu, you can't cursor along the menu to the correct one. You have to exit one and then open the next.

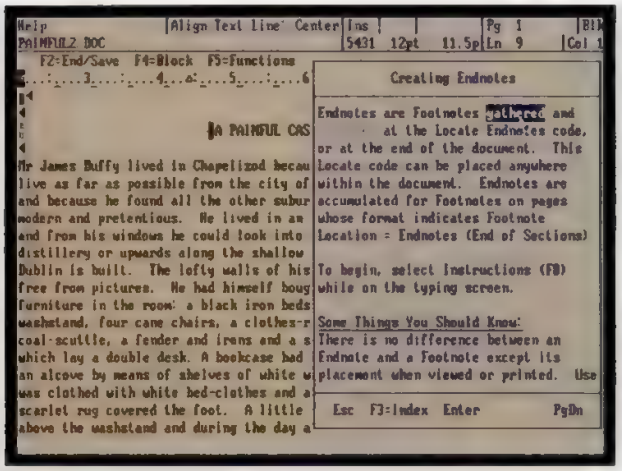
Some sets of key assignments border on the bizarre. F1 brings up help, but Alt-5 brings up a list of key assignments. Ctrl-F12 and Alt-4 both bring up the Print menu. Cursor movement can be equally strange. You can use the arrow keypad to jump to the next word, screen, or page, but Ctrl-] takes you to the next paragraph, and you have to press F6 to open the Search menu if you want to reach the top or bottom of the file.

Like other packages, *DisplayWrite* includes keyboard templates, although a printing error on one of them makes it impossible to tell which Ctrl or Alt key does what. IBM also invites you to send in for a cardboard wheel with a window that you can open to learn the keystrokes.

SOME TACTICAL ADVICE

In the first release of *DisplayWrite* 5, the cursor didn't wrap to the next line when you used the Right Arrow key to move it to the end of the line. Instead, it continued horizontally into empty space like a cartoon character running off a cliff. The cursor finally works sensibly in Revision 1, which you can get for no charge from your dealer.

If your authorized IBM dealer is like most of those I've talked to recently, he'll claim not to know anything about Revision 1 and insist that he can't get you a copy. When this happens, tell him you'll call IBM's regional sales office to ask why he can't perform this simple feat, and watch him scramble to get you a copy.



***DisplayWrite 5* has a context-sensitive, hypertext-style help system that clarifies the sometimes obscure terminology of the program. Not all options are included. The format codes displayed within the document are also obscure, but their names are displayed as you move the cursor over each one.**

CRYPTIC FORMAT CODES

DisplayWrite is the only major character-based word processor that won't display the bottom of one page and the top of another on-screen at the same time. Finally, it supports split-screen editing of two files and has a "notepad" that you can use for a third. *DisplayWrite* doesn't repaginate or adjust line endings automatically, so to change a margin or font, you have to press a few keys and wait while the program repaginates for you. At least you can tell the program to repaginate whenever it saves or prints. Format codes on-screen are incomprehensible high-order ASCII symbols. I couldn't find a list of codes in the manual, but a status line on the screen tells you which code is under the cursor.

Display Write is the only major character-based word processor that won't display the bottom of one page and the top of another on-screen at the same time.

Codes normally appear only when you move the cursor to the character in the text that follows the code—and the character then disappears and is replaced by the code until you move the cursor again. A function key conveniently opens up the menu associated with the code under the cursor. An option lets you display all codes so you can find them without moving the cursor through the file until you land on the one you need.

MISBEHAVING PRINT OPTIONS

DisplayWrite won't let you print a document while you're editing it, although it will let you print a limited number of pages. Unless you dig deep into the setup menus, something you can do only when you're not editing a file, you can't print in the background at all. Don't try to find out from the manual how to turn on background printing, although *DisplayWrite* veterans will probably figure out that they need to modify the Print Document Options under Workstation Defaults in the Modify Profile menu.

After I changed this option and loaded the revised profile, *DisplayWrite* still refused to print in the background, but told me that background printing was "not loaded." At this point I called IBM's toll-free technical support line and answered a few questions from an operator, who then

FACT FILE

DisplayWrite 5
IBM Corp., DisplayWrite Product Support Center, 5 West Kirkwood Blvd., Roanoke, TX 76299; (800) IBM-2468, ext. 126 for dealer information.
List Price: $495.
Requires: 422K RAM (additional 103K needed for background printing), DOS 3.3 or later. Mouse optional.
In Short: The DOS version of *DisplayWrite* finally includes split-screen editing, a zoomable print preview, and sensible cursor movement, but most of its functions are as awkward and obscure as in earlier versions. A power failure or random bug can make your files unusable unless you know how to recover them. Printer support is minimal compared with rival programs. If you work in an IBM-only office, wait for the next version, which will be partly written by the authors of *XyWrite*.

CIRCLE 402 ON READER SERVICE CARD

Great Teams

Top, left to right: Amelia Earhart and her Lockheed Vega; Sherlock Holmes and Doctor Watson; Orville and Wilbur Wright. Bottom, left to right: Bonnie Parker and Clyde Barrow; PrinTools and Hewlett-Packard Printers; 1980 American Olympic hockey team.

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BEFORE

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AFTER

CIRCLE 131 ON READER SERVICE CARD

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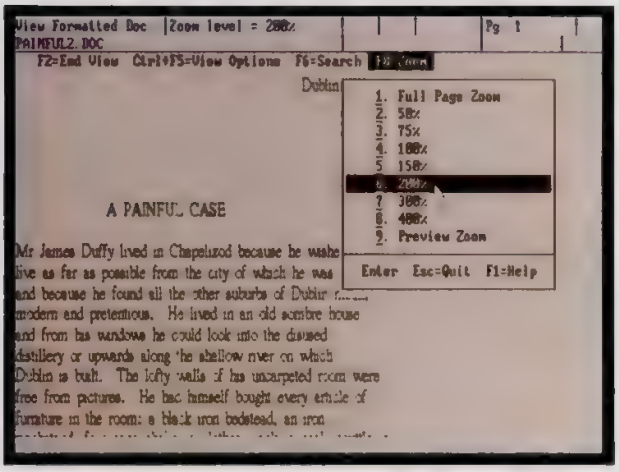
asked me how urgent the problem was and promised a quick return call. A half hour later, a friendly and knowledgeable support technician told me that although I had correctly loaded background printing with the new profile, I should exit the program and restart to get it to work correctly. When I asked why the program told me that background printing wasn't loaded, she replied, "It lies sometimes."

Another of *DisplayWrite*'s less-than-truthful messages appears when you try to open your file after the program has locked up or you've lost power. The message tells you that the file is already in use and you can't access it. Of course it isn't in use; it's merely corrupted. If you know your way around the program, you'll know to use the Recover menu to get it back.



***DisplayWrite 5*'s print preview has more zoom options than any other word processor on the market, but if you don't use the supplied Font Librarian utility to generate screen fonts, your text will be displayed in Courier.**

DESIGN GAINS AND LIMITS

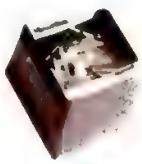
DisplayWrite now comes with a screen preview, but unless you generate a few acres of screen fonts with a separate supplied program called a Font Librarian, the preview displays all text in Courier. If your file is set to print in Times Roman, the Courier text on the preview screen simply runs off the right edge of the page. At least you can view this wildly inaccurate screen in any of eight different magnifications.

DisplayWrite can print and preview graphics, but to import them you'll need the conversion utility, available at no cost when you call and ask for it. Before you can print a file with graphics you'll have to change a few default settings, which you can do only if you realize that the error messages you got when the program first refused to print were irrelevant.

IBM reports that *DisplayWrite* now supports more than 80 printers—a figure that can be compared with *WordPerfect*'s 800. The first release of *DisplayWrite* couldn't use scalable fonts on the LaserJet III or any PostScript fonts beyond Courier, Times, and Helvetica. Revision 1 fixes both of these problems and also adds the capability of choosing fonts by name rather than by number as in the first release, although you still can't use PostScript soft fonts. Whichever fonts you use, if you switch from a 10-point to 14-point size, don't expect *DisplayWrite* to adjust the leading so that the text won't be cramped on the page. You still have to figure out for yourself how many lines per inch you want.

If you use *DisplayWrite* because you work in an office that only buys programs with "IBM" on the label, don't give up hope. IBM is working with XyQuest, the authors of *XyWrite*, on the next version of *DisplayWrite*, so dramatic improvements are probably inevitable. Meanwhile, *DisplayWrite 5* can get the job done, as long as you have plenty of patience and the job isn't too difficult.

Microsoft Word



Microsoft Word 1.0 was the first PC program that understood that the PC could be an advanced formatting instrument instead of merely a typewriter attached to a screen. Seven years later, Version 5.0 of Microsoft's package, at $450, is still the only character-based word processor that lets you create and edit the format of your documents as easily as you create the text.

Word's unique program design offers other innovative conveniences for navigating and organizing documents, including collapsible outlines and a flexible system of "bookmarks" that let you give a name to whole blocks of text. *Word* even lets you edit different parts of the same file in up to eight windows at once.

CREATING STYLESHEETS

Stylesheets are the key to *Word*'s document design—and the best reason to use *Word* in preference to its rivals. Once you set up a stylesheet, with detailed formats for titles, different types of text, headlines, running heads, and footnotes, you can assign each format to your document by pressing Alt and two letters.

If the format applies to a paragraph, you need only move the cursor anywhere in the paragraph before pressing the Alt-key combination. If the format applies to a block of characters or paragraphs, you have to define the block first, but *Word*'s cursor movement keys make the task effortless. You don't have to turn block mode on or off because *Word* is always in block mode, with the block normally limited to a single character but easily extended. *Word* can display six different

FACT FILE
EDITOR'S CHOICE

***Microsoft Word*, Version 5.0**
Microsoft Corp.,
1 Microsoft Way,
Redmond, WA 98053:
(800) 426-9400.
List Price: $450.
Requires: 384 RAM,
DOS 2.0 or later.
Mouse optional.

In Short: The DOS version of *Word* is the best character-based word processor for creating stylesheets and repetitive formats, and it has strong but overly complex support for collapsible outlines. Its printer support is beginning to look limited compared with *WordPerfect* and GUI word processors, but remains powerful. Highly programmable macros and mail-merge are notably easy to use. Version 5.5, due this fall, adds no functionality but totally overhauls the interface to provide a character-based equivalent of *Windows*. New users will find the revised interface simpler to use, but the existing user base may find the transition frustrating.

CIRCLE 403 ON READER SERVICE CARD

units of measurement on the same menu, but it displays them only in the unit you chose as the default (*WordPerfect* lets you enter measurements in any unit it accepts).

The simplest way to build a stylesheet is by applying formatting to a region of text on the editing screen and then defining that format as a style. Alternatively, you can bring *Word*'s oddly named Gallery onto the screen, where you build stylesheets blindly by specifying formatting on a menu. When you use the Gallery you can't see the effect of formatting until you return to the editing screen.

Among the formats that you can assign to text is a "hidden" attribute. You can choose at any time whether to let hidden text be viewed or printed, and you can easily create summary or full versions of documents depending on your choice. Other programs have nonprinting comments, but only *Word* lets you change hidden text into printable text and back again without special effort.

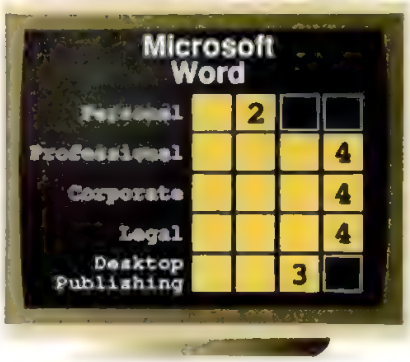
INNOVATIVE MOUSE CONTROL

Word was also the first program that unlocked all its functions only when used with a mouse. Because the cursor in the text is really a "selection" block, the mouse gives you an alternative cursor that you can move all through your file while leaving the selection in place. This means, for example, you can transpose characters, words, or sentences by defining them as a selection block, moving the mouse cursor to the preceding character, word, or sentence, and clicking while depressing the Ctrl key.

You can also browse through a long file, without moving the editing cursor, by dragging the mouse cursor along one of the scroll bars on the borders of the screen. By clicking the mouse on those scroll bars, you can open, resize, and close windows without using a menu. And the mouse races quickly though the multilevel maze of *Word*'s menu system.

If you prefer the keyboard to the mouse, menu navigation can get annoying because some menu levels let you use letter keys to choose fields while other levels force you to use the Tab or cursor keys. When you exit some low-level menus you jump back to the top even though you may want to get back to an intermediate level. Some menus let you leave by pressing Esc or Enter; others, unpredictably, make you select Exit. A chaotic set of function-key shortcuts can take you directly to some of the most used menu choices, and you can use macros to remap the keyboard to suit your tastes.

SUITABILITY TO TASK



QUASI-GRAPHICS MODE

Word lets you redesign screens with the same freedom as when it lets you redesign documents. Although you can't modify the menus, as you can with *Ami Professional* and *Word for Windows*, you can hide or display the main alphabetical menu at the foot of the screen. You can hide or display the screen borders on which you manipulate the mouse.

Word has the unique ability (shared with *Nota Bene*) to display text either with true line breaks where long lines stretch beyond the right edge of the screen, or in a mode that breaks lines before the screen edge. With either of these options, you are able to edit in ordinary text mode or in a quasi-graphics mode that displays italics, small caps, and other typographic niceties.

A keystroke switches between text and graphic modes, or between screens of the standard 25 lines and larger screens available with graphics boards. Hercules systems can enjoy a beautiful 90-column mode; EGA and VGA systems suffer from ugly graphics fonts.

COLLECTING MACROS

Another of *Word*'s unique features is its built-in glossaries, which are essentially collections of macros. You can type an abbreviation like "mx" in your text, press F3, and let *Word* expand it to "myxomatosis." Programmable keyboard macros can be accessed by similar abbreviations or with Ctrl or function keys. If you forget the macro key, you can use the abbreviation instead. Besides the default glossary, you can load special-purpose glossaries at any time.

Glossary management can be tricky. When you merge a special glossary into the default glossary you overwrite the existing entries. Although you're warned to save before making permanent changes, it's all too easy to end up with a default glossary that has entries you wanted only in a special one.

Word's well-integrated speller can automatically correct any errors that you make repeatedly (or abbreviations you want to expand) and catch some punctuation and capitalization errors. *Word*'s exceptionally powerful outlining is bettered among character-based word processors only by *Lotus Manuscript*, but it makes you jump all over the keyboard to accomplish relatively simple tasks of organizing and viewing.

MIXED BLESSINGS

Word's control over your printer used to exceed all others, but *WordPerfect* now leaves it in the dust. Unless you write a set

***Microsoft Word* lets you view more than one file, or more than one part of the same file, on-screen at the same time. You can choose different display options for each window. Here, the top window shows all nonprinting characters, while the bottom window shows only printable text.**

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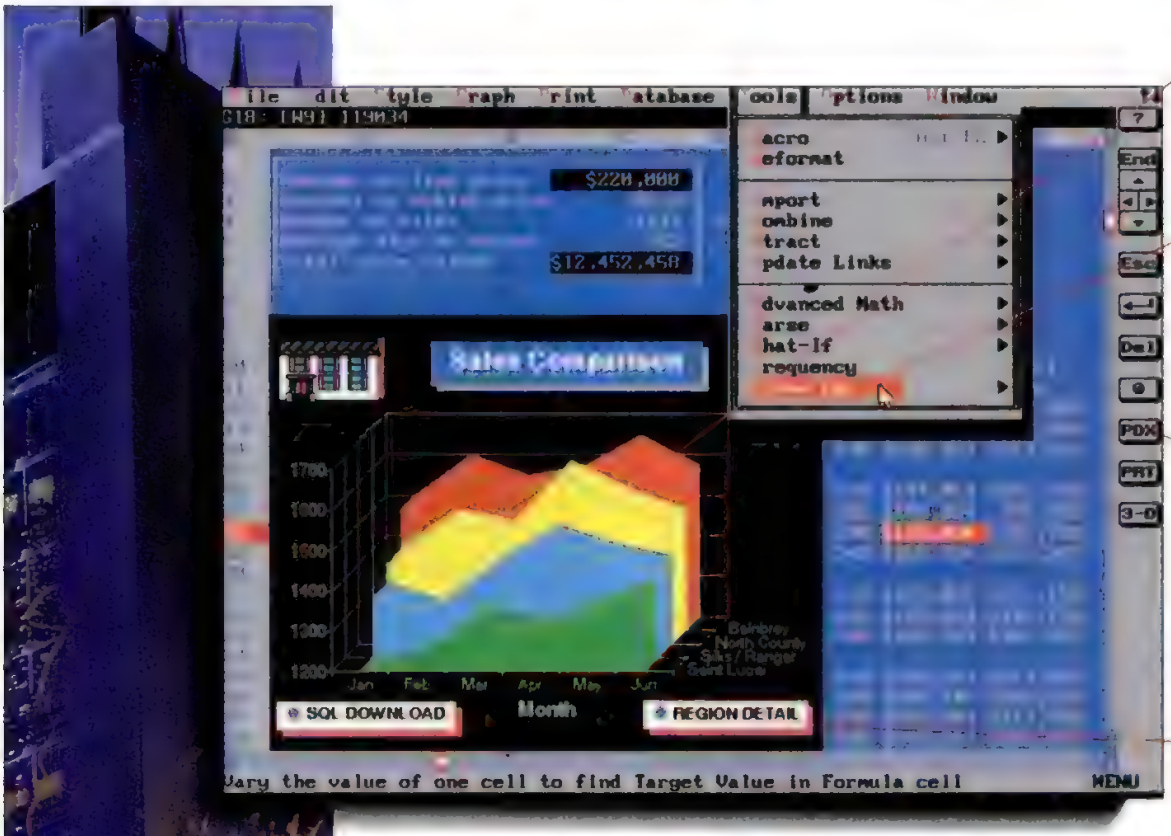

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of macros, you still have to enter foreign and special characters by typing their ASCII numbers, and then cross your fingers and hope your fonts can print them. The print preview screen gives you an image of the page that is too reduced to be useful.

Graphics handling is less robust and flexible than in *WordPerfect*, so much so that *Word* fails to print many TIFF files that *WordPerfect* handles effortlessly. *Word* makes you jump among widely scattered menus for full control over graphics layout, and it violates its own normal aversion to codes by using codes to identify linked graphics files and options. *Word* similarly uses codes to identify index entries, and data linked from spreadsheets and other documents.

Footnoting in *Word* is a mixed blessing. You can open a footnote window that displays the note whenever the associated text is in the editing screen. A useful group-editing function lets you identify annotations with the annotator's initials. But footnotes and endnotes can't be numbered automatically across the large-scale formatting regions that *Word* calls "divisions." This means you'll have to number notes manually if you want one part of your text to use snaking columns, line-numbering, or altered top or bottom margins. *Word*'s bookmark feature doubles as a tool for identifying cross-referencing and for creating "warm" links to other *Word* documents.

Word's memory-management needs some improvement. The dreaded message "Save" pops up all too often when you preform a search-and-replace operation on a long file, when you try to alphabetize even a moderately long list, or when you perform a complex macro. Buried in *Word*'s manual is a warning that if you don't save everything, you could lose your work. Microsoft says the danger has been reduced in recent versions. *WordPerfect* handles similar operations with aplomb, and without danger.

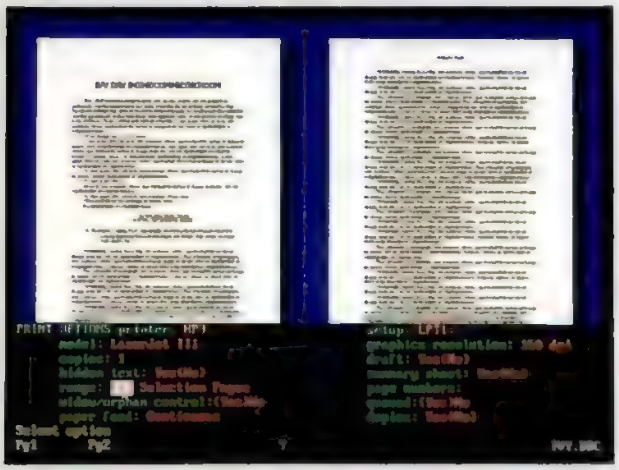
NEW INTERFACE IN THE WORKS

By the time you read this, a thoroughly revamped Version 5.5 of *Word* is due to appear. It promises a completely different screen, keyboard, and menu system that makes it look like a character-based version of *Windows*—but without any notable increase in functionality beyond compatibility with *Lotus 1-2-3*, Release 3.0, and improved screen and printer drivers.

Word 5.5 will present loyal users with a difficult choice. The new version's overlapping windows let you view stylesheets and text at the same time, and help is more extensive and more context-sensitive than before. But you now have to choose between sticking with Version 5.0 and *Word*'s familiar interface, or 5.5 with a new interface that offers conveniences like a ribbon and ruler similar to those in *Word for Windows*. For corporations that want to stick with the original interface, the box will include a copy of Version 5.0.

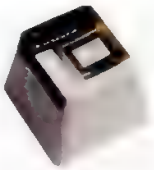
The new interface is consistent with *Windows* and Macintosh applications, but *Word* veterans will find it unsettling. The function keys from 5.0 can be retained, but most other keys and mouse maneuvers change their meaning. In the old interface, the Del key in 5.0 deletes text to a "scrap" from which it can later be inserted into a file, and Shift-Del deletes text forever. In the new interface these functions are reversed, and a lot of text is going to get lost until users grow accustomed to the change.

Word's new interface makes it possible to use the same keystrokes in *Windows* and character-based versions of the program. This is an important convenience in corporations where many computers still can't handle the *Windows* version. It's also a potential source of confusion in offices where some users may prefer the old interface. For anyone who values the unique conveniences of *Word*'s stylesheets and other formatting features, *Word*'s multiple interfaces may seem less a source of confusion than an embarrassment of riches.



You can reach *Microsoft Word's* printer options menu from its print preview, but you can't zoom in to view the page with large enough detail to check on fine points of format.

Microsoft Word for Windows



A session with *Microsoft Word for Windows* can make you rethink the whole category of word processing software. Other programs are tools for building documents, but this $495 package is an instrument for building automated systems for accessing and processing information. It may take years—and some simplification of its complex interface—before users begin to master *Word for Windows*' advanced capabilities. This program, however, already

FACT FILE
EDITOR'S CHOICE

***Microsoft Word for Windows*, Version 1.1**
Microsoft Corp., 1 Microsoft Way, Redmond, WA 98052; (206) 882-8080.
List Price: $495.
Requires: 640K RAM, DOS 3.0 or later. 1MB to 2MB EMS memory recommended; mouse recommended. Ships with runtime version of *Windows*, but full version of *Windows* is recommended.
In Short: *Word for Windows*, now updated to full compatibility with *Windows* 3.0, is an exceptionally strong word processor and an innovative set of macro and merge tools for automated control over data. Its use of the *Windows* interface has some clumsy patches, and its treatment of graphics is relatively weak, but it has more keyboard shortcuts and built-in conveniences than any other GUI word processor.

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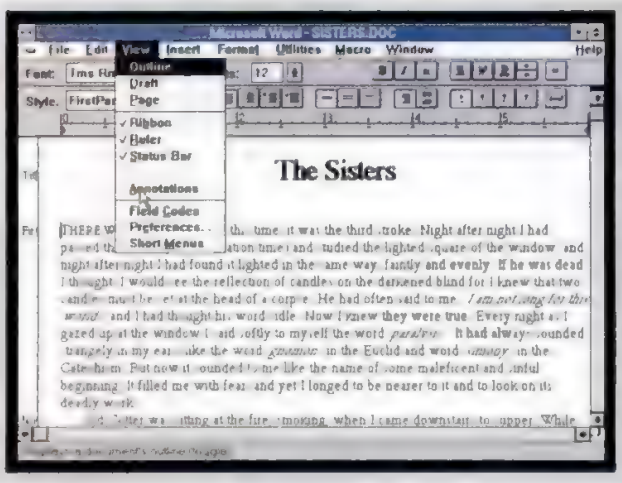
makes possible documents that request user input as soon as they are created, that summon information from other files and other applications, and that either protect themselves from modification by anyone other than their authors or modify themselves according to a reader's command.

Of course, if your requirements from a word processor are more modest than this, *Word for Windows* is equally adept at producing well-formatted text on paper. Text entry and editing are generally faster than with other graphics-based programs, although still far slower than character-based ones. And you get an amazingly rich variety of cursor-movement keys and mouse maneuvers, including keys that automatically move a paragraph up and down through a file. *Word* lets you open up to nine documents at one time, and it shares with the DOS version of *Word* the essential and virtually unique ability to view and edit different parts of the same file on the same screen.

Version 1.0 of *Word for Windows* was compatible with *Windows* 3.0 but didn't support its 3-D menus. Version 1.1 (upgrade price $7.50, or $150 for users of DOS versions of *Word*) improves *Windows* 3.0 compatibility and adds some new macros and import filters. A version for OS/2 Presentation Manager, with an interface virtually identical to the *Windows* version, is due soon.

THE GRAPHICAL ADVANTAGE

Word for Windows lets you enter text in one of three slow WYSIWYG modes or a fast draft mode. Of the three graphics modes, the normal mode displays paragraph formatting and line breaks, but it doesn't show snaking columns, footnotes, headers, and similar elements in their true position, and page breaks are indicated by a thin line. An outline mode shows outline headings in hierarchical display, with an icon bar that allows you to reshape the outline with a mouse click. A page mode shows you headers, footnotes, and columns in their true positions.



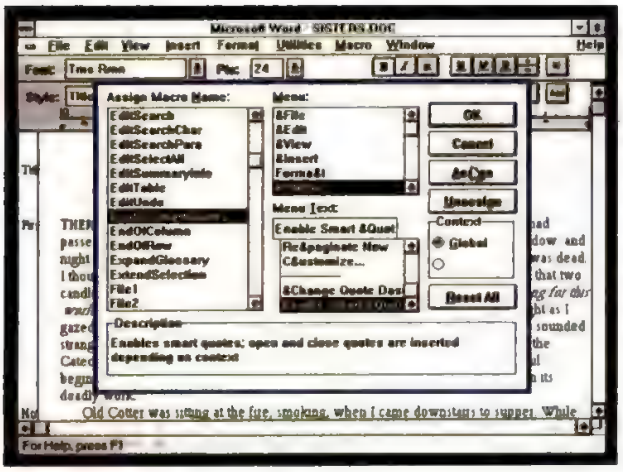
***Microsoft Word for Windows* in full glory displays a ribbon and ruler with 3-D buttons, a status bar that indicates the cursor position or explains the current option on the pull-down menus, and an expandable panel at the left with the names of the style tags for each paragraph. All of these options can be turned off.**

Somewhat confusingly, normal mode doesn't appear on the menu; you turn it on by turning off any other active mode. You can also turn on a painfully slow, reduced-scale page preview mode that forces you to display every page in turn if you want to move from the first to the last page of a file—but this is the only way to see a full page on a standard monitor.

In WYSIWYG modes you can display or conceal "hidden" text, which can also be converted to and from printable text. You can also display paragraph marks, pictures, table guides, a style-name bar in the left margin, a "ribbon" that lets you choose font and other text attributes by clicking on icons, and a very fancy version of a tab ruler that lets you choose paragraph styles, line spacing, and justification. Click once or twice on the rightmost icon in the ruler and you can modify page margins or columns instead of tabs.

To create headers or notes you have to start with menu commands that will open special windows in normal mode or jump the cursor into the margin in page mode. The header window lets you click on icons to insert the codes for page numbering, date, and time. As in DOS *Word*, the footnote and annotation window can be kept open so that you see all your notes at the bottom of the screen as the associated text scrolls through the top. Once you've created a header or note, you can edit it in page-view mode by moving the cursor beyond the text margin. However, you can't use this simple method to create a header or note as you can with *Ami Professional*.

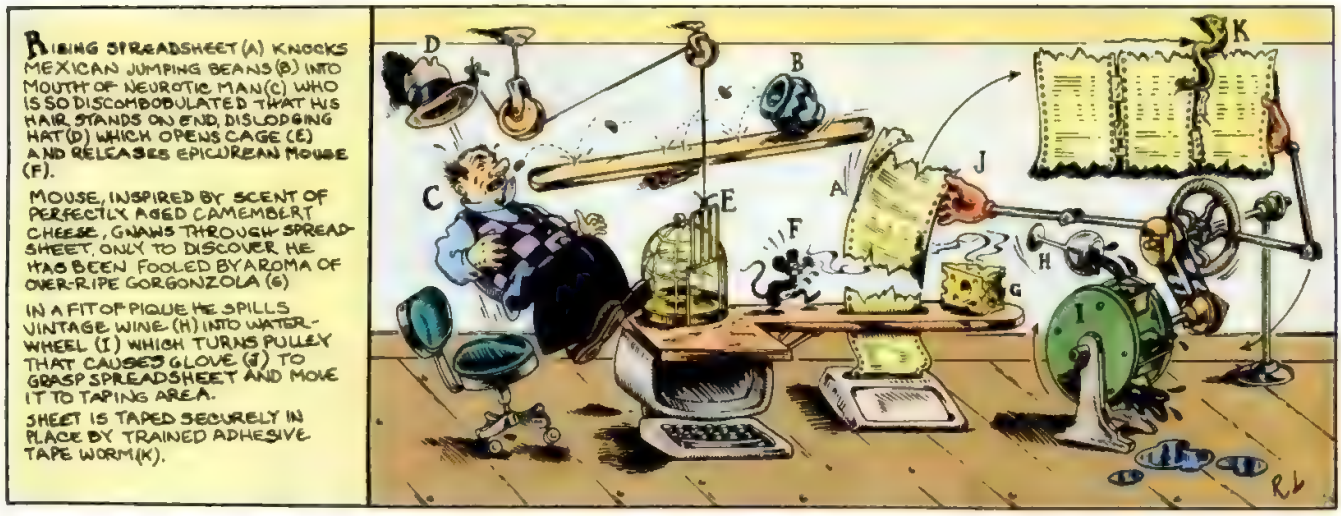
When you insert a TIFF or .PCX file, you can't drag it around the page with the mouse, although you can cut and paste it as if it were text. However, if you enter a fixed location for it on a menu you can then move it in page preview mode. If you want to create snaking columns on the same page with single-column text, you don't have to open a frame and hope that the new text will fit. You simply insert an invisible break and specify the number of columns in a menu. When you switch to draft mode, columnar text appears with the rest of your text—and doesn't temporarily disappear as it does in *Ami Professional*.



***Word for Windows* offers a menu that actually lets you modify its menus. You can move choices from one menu to another, or as shown here, you can take one of the macros supplied with the program and install it in any menu.**

MASTERING MENUS

Menus in *Word for Windows* tend to do more than you expect if you don't study



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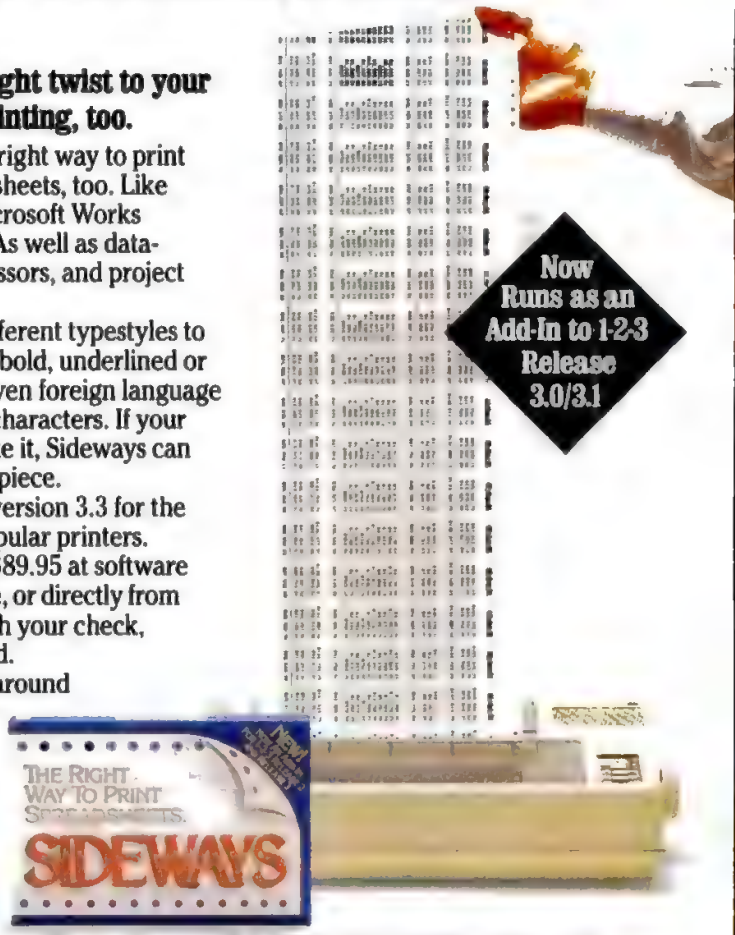

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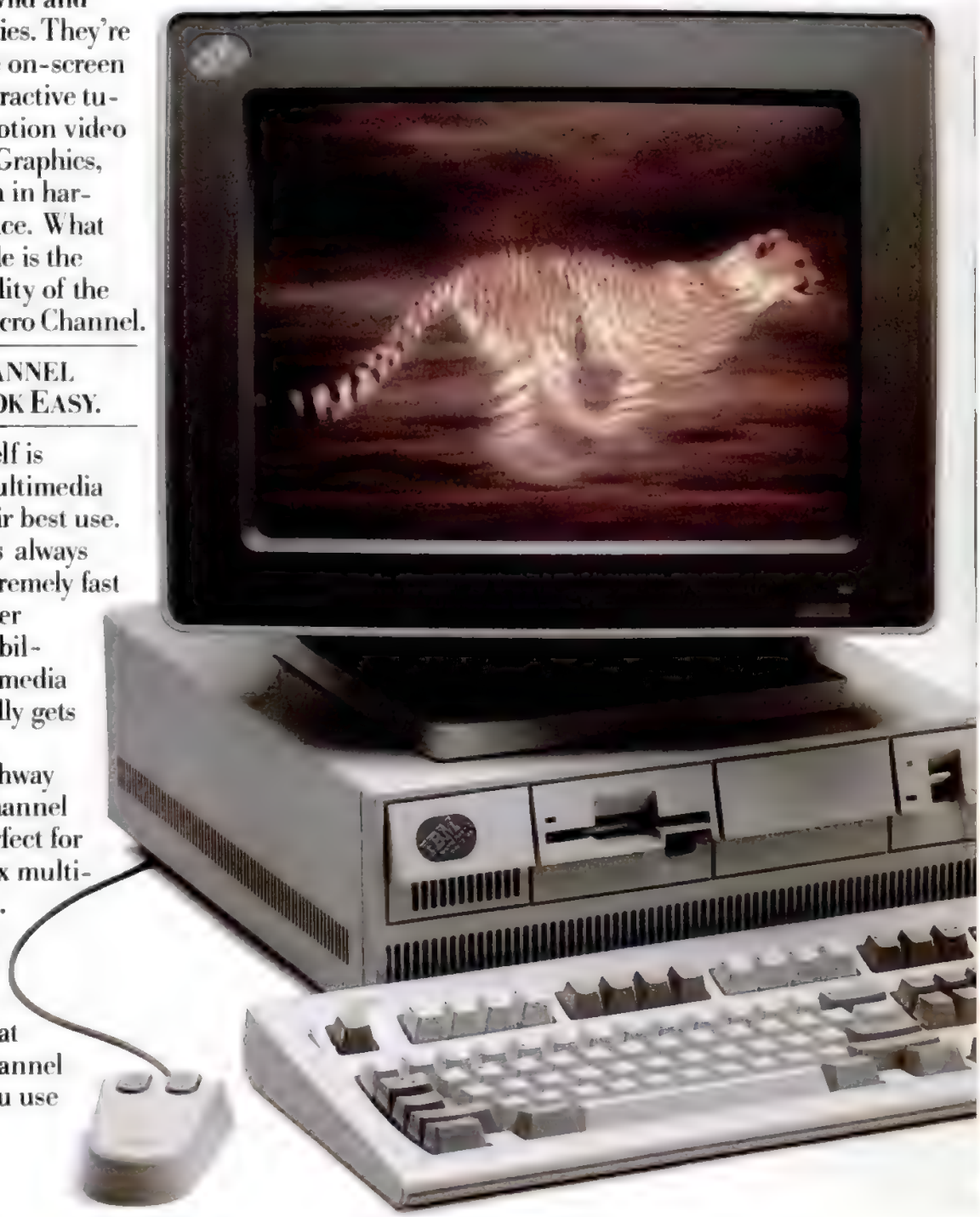

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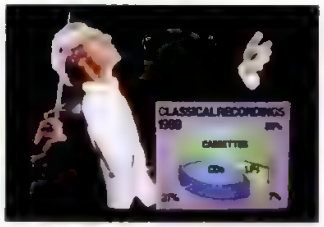

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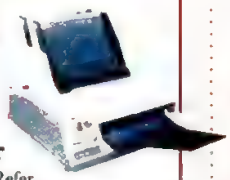

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the manual. When you open the Edit/GoTo menu, you're prompted to enter a page number or the name of an optional bookmark, which, as in DOS *Word*, can include large blocks of text.

The prompt doesn't tell you that you can also enter line numbers, footnote or annotation numbers, or even a relative number of lines or pages forward or back from the cursor location. You can even enter a percentage of the length of the file. Shortcuts like this turn up throughout the program in a profusion that approaches the richness of a mature character-based product such as *WordPerfect*.

Not all the menu options are blessings, especially when crucial ones aren't displayed. For example, on the Format Paragraph screen, if you enter a fixed line spacing that's smaller than the automatic spacing for the current font, *Word* accepts the number on the menu, but it ignores this when printing and uses the automatic setting instead. Only in the manual or help file can you learn, after hours of frustration, that you must enter a nonobvious negative number if you want line spacing smaller than the automatic setting.

THE DOS HERITAGE

Stylesheets in *Word for Windows* are based on those in DOS *Word*—a strong but sometimes awkward heritage. You can create a style by formatting a paragraph with the ribbon, ruler, or menus, and then hit a key and give a name to the new style. Or you can build a style by entering its specifications in a menu. Unfortunately, you have to open separate menus for character, paragraph, tabs, and position. There's no good reason for this except that DOS *Word* does things similarly.

Word for Windows lacks the character styles of its DOS-based ancestor (which reduces the usefulness of hidden text) but improves on DOS *Word* by letting a paragraph style automatically assign another style to the paragraph immediately following it. You can also define styles as "based on" a specified style, and when that specified style changes, all the styles based on it will change also. This allows global changes in font and point size comparable to those in *WordPerfect*.

HIGHLY EVOLVED FIELDS

The most powerful and flexible part of *Word for Windows* is its fields. Some of these fields resemble those that rival programs use in their mail-merge functions to prompt users for input or to extract data from other files. In *Word for Windows* these prompts and functions can operate automatically in almost any situation.

Some fields resemble the codes used in other programs where the printed value of the code varies according to circumstances, as in codes for page numbers,

SUITABILITY TO TASK

index references, fields from document summaries, and date or time. But *Word for Windows*' fields also have the unique power to make the cursor jump to a bookmark or run elaborate macros when you click on a field's "button" in a file. The button can be as unobtrusive as an ordinary-looking word in your text.

Fields can perform calculations using simple arithmetic operators or any of 16 functions, which include rounding and averages. Equipped with these functions, *Word for Windows*' tables approach the power of a spreadsheet far more closely than the rudimentary tables offered in rival word processors.

PRODUCTIVITY TEMPLATES

If you combine fields with *Word for Windows*' system of document templates, you can build automated systems for creating and processing files. As the name implies, templates are models on which to build other documents, and they can include anything from simple formatting to tables with formulas, fill-in forms with automatic prompts, and glossaries like those in DOS *Word* that let you store text under abbreviated names.

Shortcuts turn up throughout *Word for Windows* in a profusion that approaches the richness of a mature character-based product such as *WordPerfect*.

Templates can incorporate macros that run whenever you create or open a file. These macros can prompt you with message boxes that include radio buttons and other features of the *Windows* interface. Using these macros, corporate managers can create complex systems that prompt for data entry, transfer data to and from other *Windows* applications via DDE hot links, or hand-hold a user through the process of building a complete document. A macro in a template can alter the standard pull-down menus to remove extraneous items or add macros as new items. You can have different sets of menus that appear when users create memos, reports, long documents, or anything else.

You can study *Word*'s WordBASIC macro language from an on-line file or a more complete $19.95 technical reference manual sold in bookstores. If you want to eliminate some of *Word for Windows*' inconveniences you should learn at least the basics of WordBASIC. You'll need a macro to tell the program which document directory to use as its default or to strip excess carriage returns from ASCII files. And you can add *Word for Windows*' built-in macros, or your own, to any of the standard menus.

The most notable weakness of *Word for Windows* is its sometimes shaky control over your printer. Version 1.1 still doesn't correct a bug that sometimes causes text in tables to print with the last character of a word turned over to the next line. This seems not to be problem in the *Windows* printer drivers, because the same table prints perfectly from *Ami Professional*.

Word for Windows doesn't have *WordPerfect*'s ability to print special characters easily and reliably. The best it offers instead is a keycaps chart that displays at glacial slowness and lets you copy special characters to the clipboard for insertion in your file.

Most of the time you won't notice these problems. *Word for Windows* is the most ambitious and successful new word processor to appear in many years, with power and flexibility to last.

WORD PROCESSORS: SUMMARY OF FEATURES

Products listed in ascending price order

	Professional Write	Microsoft Word	Ami Professional	Display-Write 5	Microsoft Word for Windows	MultiMate	WordPerfect	WordStar
Cost of master program	$249	$450	$495	$495	$495	$495	$495	$495
Network version available	■	■	■	■	■	■	■	■
Cost per additional user in network	$185	$295	$199	$295	$395	$195	$295	$150
OPERATING ENVIRONMENT								
DOS	■	■	□	■	□	■	■	■
Microsoft Windows 3.0	□	□	■	□	■	□	□	□
DDE support	□	□	■	□	■	□	□	□
MEMORY/DISK USAGE								
Uses expanded memory	□	■	■	■	■	■	■	□
Disk space used by default installation	2.4MB	2MB	2.5MB to 4.4MB	10MB	3.2MB	6MB	4.5MB	4MB
Program can run from 360K floppy disk	■	■	□	□	□	□	□	■
Program can run from 720K floppy disk	■	■	□	□	□	□	■	■
Program loads entirely into memory	■	□	□	□	□	□	□	□
TEXT FORMATTING FEATURES								
Continuous underline	■	■	■	■	■	■	■	■
Broken underline	■	□	■	■	■	□	■	■
Double underline	□	■	■	□	■	■	■	□
Superscript/subscript	■	■	■	■	■	■	■	■
Italics	■	■	■	■	■	■	■	■
Overstrike	□	■	■	■	■	■	■	■
Strikethrough	□	■	■	■	■	■	■	■
Small capitals	□	■	■	□	■	□	■	□
Nonprinting comments	□	■	■	■	■	■	■	■
Adjustable top and bottom margins	■	■	■	■	■	■	■	■
Variable page length in document	■	■	■	■	■	□	■	■
Vertical centering	□	■	■	□	■	□	■	■
Tabs can be entered anywhere	■	■	■	■	■	■	■	■
Tabs move when left margin changes	□	■	■	■	■	■	■	■
Hard page breaks	■	■	■	■	■	■	■	■
Conditional page breaks	□	■	■	■	■	□	■	■
Paragraphs can be linked to remain on one page	□	■	■	■	■	□	■	□
Unbreakable blocks	□	■	■	■	■	□	■	■
Widow/orphan control	■	■	■	■	■	■	■	■
Automatic page numbering	■	■	■	■	■	■	■	■
Automatic page numbering after reformatting	■	■	■	□	■	■	■	■
Headers/footers	■	■	■	■	■	■	■	■
Kerning pairs supported by printer	□	□	■	□	■	■	■	■
Lock indent (left)	□	■	■	■	■	■	■	■
Lock indent (left and right)	□	■	■	□	■	□	■	■
Decimal line spacing	□	■	■	□	■	□	■	■
Spacing adjusts to font height	□	■	■	□	■	□	■	■
Variable line spacing within document	■	■	■	■	■	■	■	■
COMMAND STRATEGY								
Full-screen menus	■	■	□	□	□	■	■	□
Partial-screen menus	■	■	■	■	■	■	■	■
Can bypass menus from keyboard	■	■	■	■	■	■	■	■
Command line	□	□	□	■	□	□	□	□
SCREEN DISPLAYS								
Ruler line can be suppressed	□	□	■	□	■	□	■	■
Visible page-break option	■	■	■	■	■	■	■	■
Paragraph-marker option	□	■	■	■	■	■	■	■
Format codes can be displayed	□	■	■	■	■	□	■	■

□ —Editor's Choice
N/A—Not applicable: Product does not have this feature. ■—Yes □—No

CONTINUES

WORD PROCESSORS: SUMMARY OF FEATURES

	Professional Write	Microsoft Word	Ami Professional	Display-Write 5	Microsoft Word for Windows	MultiMate	WordPerfect	WordStar
TEXT ENTRY AND EDITING								
Status messages (CapsLock, etc.)	■	■	■	■	■	■	■	■
One-step deleting of:								
Entire word	■	❑	■	■	❑	❑	■	■
Entire line	■	❑	■	■	❑	❑	■	■
Sentence	❑	❑	■	❑	❑	❑	❑	❑
Paragraph	❑	❑	■	❑	❑	❑	❑	❑
Page	❑	❑	■	❑	❑	❑	❑	❑
Columns	❑	❑	❑	❑	❑	❑	❑	❑
Undelete capability	❑	■	■	■	■	■	■	■
Number of undelete levels	None	1	4	1	1	Unlimited	3	None
Mouse-controllable cursor	❑	■	■	■	■	❑	■	❑
One-step blocking of word	❑	■	■	❑	■	■	❑	❑
One-step blocking of line	❑	❑	■	❑	■	❑	❑	❑
One-step blocking of sentence	❑	■	■	❑	■	■	❑	❑
One-step blocking of paragraph	❑	■	■	❑	■	■	❑	❑
One-step blocking of column	❑	■	❑	❑	■	❑	❑	❑
One-step blocking of page	❑	❑	❑	❑	❑	❑	❑	❑
Block can be extended	❑	■	■	❑	■	❑	■	■
Automatic reformatting	■	■	■	■	■	■	■	■
Copies or moves to another window	❑	■	■	■	■	■	■	■
Saves reformat parameters to a file	■	■	■	■	■	■	■	■
Appends block to an existing file	■	❑	❑	■	❑	❑	■	■
Search-and-replace capability:	■	■	■	■	■	■	■	■
Forward and backward	❑	■	■	❑	❑	■	■	■
Verifies replace	■	■	■	■	■	■	■	■
Searches within other files	■	■	❑	❑	■	❑	■	❑
Performs case-sensitive search	■	■	■	❑	■	■	❑	■
Preserves case when replacing	■	■	■	❑	■	■	■	■
Recognizes whole words	❑	■	■	■	■	❑	❑	■
Uses wildcards	❑	■	■	❑	■	❑	■	■
Search-and-replace format codes or settings	❑	■	■	■	■	■	■	■
Search-and-replace for text attribute	❑	■	■	■	■	■	■	■
Number of text windows	None	8	9	2	8	None	2	2
PRINTING								
Supports PostScript printers	■	■	■	■	■	■	■	■
Number of printers supported	185	250	130	780	130	450	803	450
Can modify printer drivers	❑	■	❑	■	❑	■	■	■
Can work with multiple printers	■	■	■	■	■	■	■	■
Background printing	❑	■	■	■	■	■	■	■
Queues documents for printing	❑	■	■	■	■	■	■	❑
Can change print queue	❑	❑	■	■	■	■	■	❑
Prints block	❑	■	❑	❑	■	❑	■	❑
Prints continuous range of pages	■	■	■	■	■	■	■	■
Prints discontinuous pages	❑	■	❑	■	❑	❑	■	■
Prints current page without specified page number	❑	❑	❑	■	❑	■	■	❑
Explicit support for characters not in IBM character set	❑	❑	■	■	■	❑	■	■
Automatic envelope formatting and printing	■	■	■	❑	■	❑	■	❑
Landscape printing	■	■	■	■	■	❑	■	■

Ⓡ —Editor's Choice
N/A—Not applicable: Product does not have this feature. ■—Yes ❑—No

CONTINUES

WORD PROCESSORS: SUMMARY OF FEATURES

	Professional Write	Microsoft Word	Ami Professional	Display-Write 5	Microsoft Word for Windows	MultiMate	WordPerfect	WordStar
FILE HANDLING								
Maximum file size	Unlimited	8.3MB	Unlimited	2.4MB	Unlimited	1.5MB	Unlimited	Unlimited
Performs backup at timed intervals	□	■	■	□	□	■	■	■
Includes file-management functions	□	■	■	■	■	■	■	■
Searches disk for a filename	□	■	□	■	■	□	■	■
FILE IMPORT EXPORT								
FAX format	□/□	□/□	□/□	□/□	□/□	■/■	□/□	□/□
DCA	■/■	■/■	■/■	■/■	■/■	■/■	■/■	■/■
Lotus 1-2-3	■/□	■/□	■/□	■/□	■/□	■/□	■/□	■/□
Microsoft Word	■/■	■/■	■/■	□/□	■/■	■/■	■/□	■/■
MultiMate	■/■	□/□	■/■	□/□	■/■	■/■	■/■	■/■
WordPerfect	■/■	□/□	■/■	□/□	■/■	■/■	■/■	■/■
WordStar	■/■	□/□	■/■	□/□	■/■	■/■	■/■	■/■
SPELL CHECKING								
Has spell checker	■	■	■	■	■	■	■	■
Number of words in dictionary	77,000	130,000	130,000	120,000	130,000	118,000	115,000	100,000
Maximum number of dictionaries	1	2	1	3	3	1	1	1
Spell-checks single word	■	■	■	■	■	■	■	■
Spell-checks defined block	□	■	■	□	■	■	■	□
Checks as you type option	□	□	□	□	□	□	□	□
Specialized spell checkers:								
Legal	□	■	□	■	■	■	□	■
Medical	□	■	□	■	■	■	□	■
Other	□	■	■	■	■	■	■	■
HYPHENATION AND THESAURUS								
Based on algorithm or dictionary	Algorithm	Dictionary	Algorithm	Both	Both	Algorithm	Dictionary	Algorithm
Uses hot zone for hyphenation	■	□	■	■	■	■	■	■
Inserts soft hyphens automatically	■	■	■	□	■	□	□	■
Can enter hyphens from keyboard	□	■	■	■	■	■	■	■
Readjusts additions and deletions	■	■	■	■	■	■	■	■
Thesaurus provided	■	■	■	■	■	■	■	■
Antonyms provided	□	□	□	□	□	□	■	□
MANUSCRIPT PREPARATION								
Table of contents:								
Multilevel formats	□	■	■	■	■	■	■	■
Has footnote/endnote capability	□	■	■	■	■	■	■	■
Different fonts	□	■	■	■	■	□	■	■
Auto-numbering	□	■	■	■	■	■	■	■
Has indexing capability	□	■	■	■	■	■	■	■
Multilevel indexing	□	■	■	■	■	■	■	■
Cross-referencing	□	■	□	□	■	□	■	□
DESKTOP PUBLISHING FEATURES								
Snaking columns	□	■	■	■	■	■	■	■
Single and snaking columns on same page	□	■	■	■	■	■	■	■
Maximum number of columns	N/A	22	8	12	32	8	24	8
Has full-justification and microjustification	□	■	■	■	■	■	■	■
Side-by-side columns	□	■	■	■	■	■	■	■
Unmatched column widths available	□	■	■	■	■	■	■	■
Adjustable gutter width	□	■	■	■	■	□	■	■
Restores single columns automatically	□	■	■	■	■	■	■	■
Column width defined by cursor	□	□	■	□	■	■	■	□
Line drawing using cursor	■	■	■	■	□	■	■	□
Line drawing using menu	□	■	■	□	■	□	■	□
Expandable box around text	□	■	■	□	■	□	■	□
Imports graphics format files	■	■	■	■	■	■	■	□

★ —Editor's Choice
N/A—Not applicable: Product does not have this feature. ■—Yes □—No

CONTINUES

Software for Windows and OS/2

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WideAngle is perfect for the busy professional. Arrange your applications according to how YOU work. Jump from one task to another, or workspace to workspace, with a click of your mouse – without the constant moving or resizing of windows. It couldn't be easier!

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WORD PROCESSORS: SUMMARY OF FEATURES

	Professional Write	Microsoft Word	Ami Professional	Display-Write 5	Microsoft Word for Windows	MultiMate	WordPerfect	WordStar
DESKTOP PUBLISHING FEATURES (CONT'D)								
Graphics files imported	First Graphics, Harvard Graphics	.EPS, HPGL, .PCX, .PIC, TIFF	HPGL, .PCX, .PIC, TIFF	.CGM, .PCX, .PIC	.CGM .EPS, HPGL, .PCX, .PIC, TIFF	.CGM, .MSP, .PCX, .PIC, TIFF	.ESP, .PCX, .PIC, TIFF	N/A
Resizes imported graphics	❑	■	■	❑	■	■	■	■
Text flows around graphics	❑	■	■	❑	■	❑	■	❑
Page preview	■	■	■	■	■	■	■	■
Supports full-page portrait monitor	❑	■	■	❑	■	❑	■	■
Zoom image	■	❑	■	■	❑	■	■	■
Files directly exportable to:								
PageMaker	❑	■	❑	❑	❑	■	❑	❑
Ventura Publisher	❑	■	❑	❑	❑	■	❑	❑
NUMERIC FEATURES								
Dynamic table functions	❑	■	■	❑	■	❑	■	❑
Can perform arithmetic operations within document	■	■	■	■	■	■	■	■
Keyboard calculations	■	❑	■	❑	❑	■	❑	■
Pop-up calculator	■	❑	❑	❑	❑	❑	■	■
CORPORATE AND PROFESSIONAL FEATURES								
Mail-merge	■	■	■	■	■	■	■	■
Maximum number of records	2,000	Unlimited	Unlimited	65,000	Unlimited	Unlimited	Unlimited	Unlimited
Mailing labels	❑	■	■	■	■	❑	■	■
Passwords	❑	❑	❑	❑	■	❑	■	❑
File encryption	■	❑	❑	❑	❑	❑	■	❑
Preformatted forms processing	❑	■	■	❑	■	■	❑	❑
GROUP EDITING AND FILE COMPARISON								
Revision marking	❑	■	❑	■	■	■	■	❑
Changes verified one by one	❑	■	❑	❑	■	■	■	❑
File comparison	❑	❑	❑	❑	■	■	■	❑
Outline numbering	❑	■	■	■	■	■	■	■
Collapsible outlines	❑	■	❑	❑	■	❑	❑	❑
Telecommunications module	❑	❑	❑	❑	❑	■	❑	■
MACROS								
Includes macro facility	■	■	■	■	■	■	■	■
Programmable macros (with if/then)	❑	■	■	❑	■	❑	■	❑
Keyboard recording mode	■	■	■	■	■	■	■	❑
SORT ROUTINES								
Includes sort routines	❑	■	■	■	■	■	■	■
User can elect fields for sorting	❑	■	■	■	■	■	■	■
HELP, DOCUMENTATION, ERROR HANDLING								
On-line help	■	■	■	■	■	■	■	■
Context-sensitive on-line help	■	■	■	■	■	■	■	■
Adjustable help levels	❑	❑	❑	❑	❑	❑	❑	■
Keyboard templates	❑	■	❑	■	■	■	■	❑
INSTALLATION								
Automated installation	❑	■	■	■	■	■	■	■
Hardware environment recognized automatically	❑	■	❑	■	■	■	■	■
Error messages:								
Explains error	■	■	■	■	■	■	■	■
Suggests remedy	■	■	■	■	❑	❑	■	■
TECHNICAL SUPPORT								
Free support	■	■	■	■	■	■	■	■
Toll-free telephone number	❑	❑	❑	■	❑	❑	■	❑

—Editor's Choice
N/A—Not applicable: Product does not have this feature. ■—Yes ❑—No

ENDS

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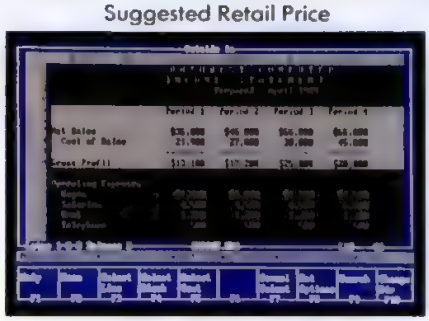
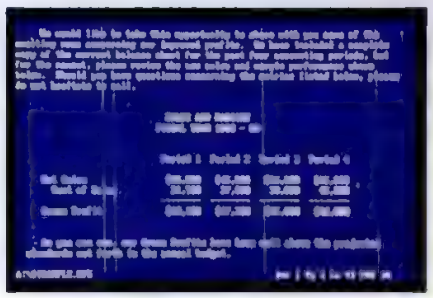


Zoom to a screen-wide view of any individual file. Cursor through the file to find the portion you want to copy into your word processor's current file. Select the portion to copy, then press the Insert key.



Text or data is imported directly into your word processor's file and adopts the margins, columns, fonts, line spacing and tabs stops of your document. Boldface, underline, italics, and tabs from the source document are retained.

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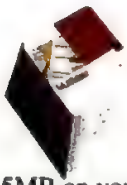
CIRCLE 110 ON READER SERVICE CARD

MultiMate



If you measure programs by their size, *MultiMate* is the heavyweight of word processors. Even a simple installation will probably fill more than 5MB on your hard disk. All those megabytes now include graphics editing, a grammar checker, MHS electronic mail, and *MultiMate*'s traditionally sturdy mail-merge. Unfortunately, like many heavyweights, Ashton-Tate's enormous program moves slowly and awkwardly, and likes to insist on doing things its own way.

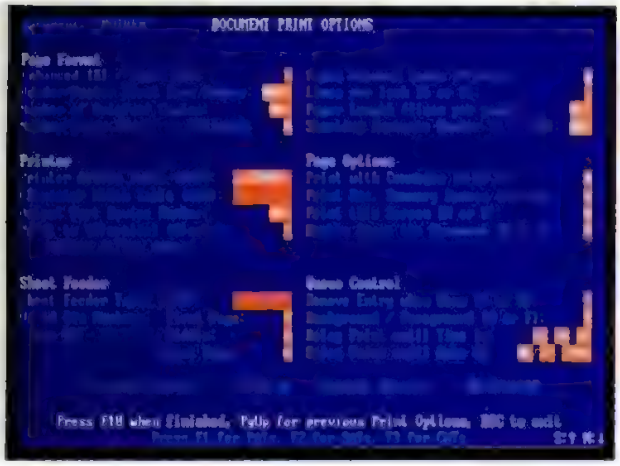
If you're used to earlier versions of the program, or the Wang word processing hardware on which it was originally modeled, *MultiMate*'s way may be your way. If you're used to rival programs, you may find it takes some getting used to. *MultiMate*'s interface combines an older set of function key and Alt-key assignments with new pull-down menus; the menus provide some but not all of the functions of the other keys. You turn on the sleek-looking pull-down menus with Alt-L, but some of the menu items take you directly to *MultiMate*'s old-style menus, which pack a lot of options onto one confusing screen. If you prefer to use the Alt-key combinations, prepare to remember such arbitrary assignments as Alt-C for fonts and pitch, Alt-U for outline-style section numbers, and Alt-W for subscripts. *MultiMate* prompts you often, and almost always in ugly capital letters.

BARRIERS TO DATA ENTRY

Although *MultiMate* lets you see the end of one page and the start of another on-screen, it retains much of the page orientation of its early days. In fact, it can still be configured to display only one page at a time. When you first enter text, *MultiMate* paginates automatically. But when you try to add text to an existing page, the page-line indicator at the top of the screen will start to blink as a warning that you've gone past the foot of the page. The text at the foot of the page won't automatically flow over to the next. Amazingly, *MultiMate* expects you to solve this problem either by pressing a function key to insert a page break or by pressing another function key and choosing repagination from a menu.

Because *MultiMate* accepts only a limited number of bytes per page, you will be frustrated if you try to import text into an existing file. To import part or all of a text file, you start from the document into which you want to import it. Press a function key (or choose a pull-down menu item) for "external copy." Choose the file from a menu, and wait a second or two while *MultiMate* transparently converts the file into its own format. You are then prompted to mark the block that you want to import, and the program then takes you back to your document. There, you are likely to be flashed a message that the block is too large and the whole operation will be aborted. The trouble is that you've tried to import more text than *MultiMate* can fit on a page. So you start over by inserting a couple of page breaks and importing the text in between. Then you remove the page breaks or repaginate.

Transferring data would be easier if you could open and edit two files at the same time, but *MultiMate* gives you only one editing window. The redlining function lets you compare two files in a split screen, but you can't edit either file while comparing them.



***MultiMate*'s screen displays format codes and ruler lines, and you can't suppress them. In order to get a heavily edited document to print correctly you have to repaginate from the Document Reorganization menu, which uses awkward Alt-number keystrokes for selecting options.**

INCONVENIENT INTERFACE

Similar inefficiency pervades almost the entire program. In the default setup, the Backspace key erases characters in the editing screen but doesn't erase in the screen used for entering a search string. A soft hyphen inserted during manual or automatic hyphenation—a function that can be combined with repagination—is lost if your editing temporarily moves the hyphenated word away from the right margin. Help is not context-sensitive; it consists of brief screens explaining individual keys that you can press from a top-level index.

Before you can print a file, you face a bewildering menu on which you can't simply choose an option like margins or font but have to cursor your way through all the other options to reach the one you want. You can select fonts from a menu while you're in the editing screen, but if you choose to change the default font from the print menu, you'll have to remember which letter corresponds to the font you want, or consult a printout that you can make when you install a printer.

MultiMate is still designed primarily for fixed-pitch fonts, and even if you choose to justify text using proportional fonts, the lines will break where they would if you were using a fixed-pitch font, and the page will look clumsy.

For line breaks calculated according to the width of the characters in the font, you

FACT FILE

***MultiMate*, Version 4.0**
Ashton-Tate Inc., 20101 Hamilton Ave., Torrance, CA 90502; (213) 329-9989.
List Price: $495.
Requires: 384K RAM (464K for all functions), DOS 3.1 or later.
In Short: *MultiMate*'s flat-footed interface, single-screen editing, single-page orientation, and limited help system makes it suitable for simple documents only. Printer support is weak in normal operations, and if you want properly spaced proportional printing, you must give up most control over the appearance of your files. Files are saved after every page, so security is strong. Mail-merge is powerful but less programmable than in the best word processors.

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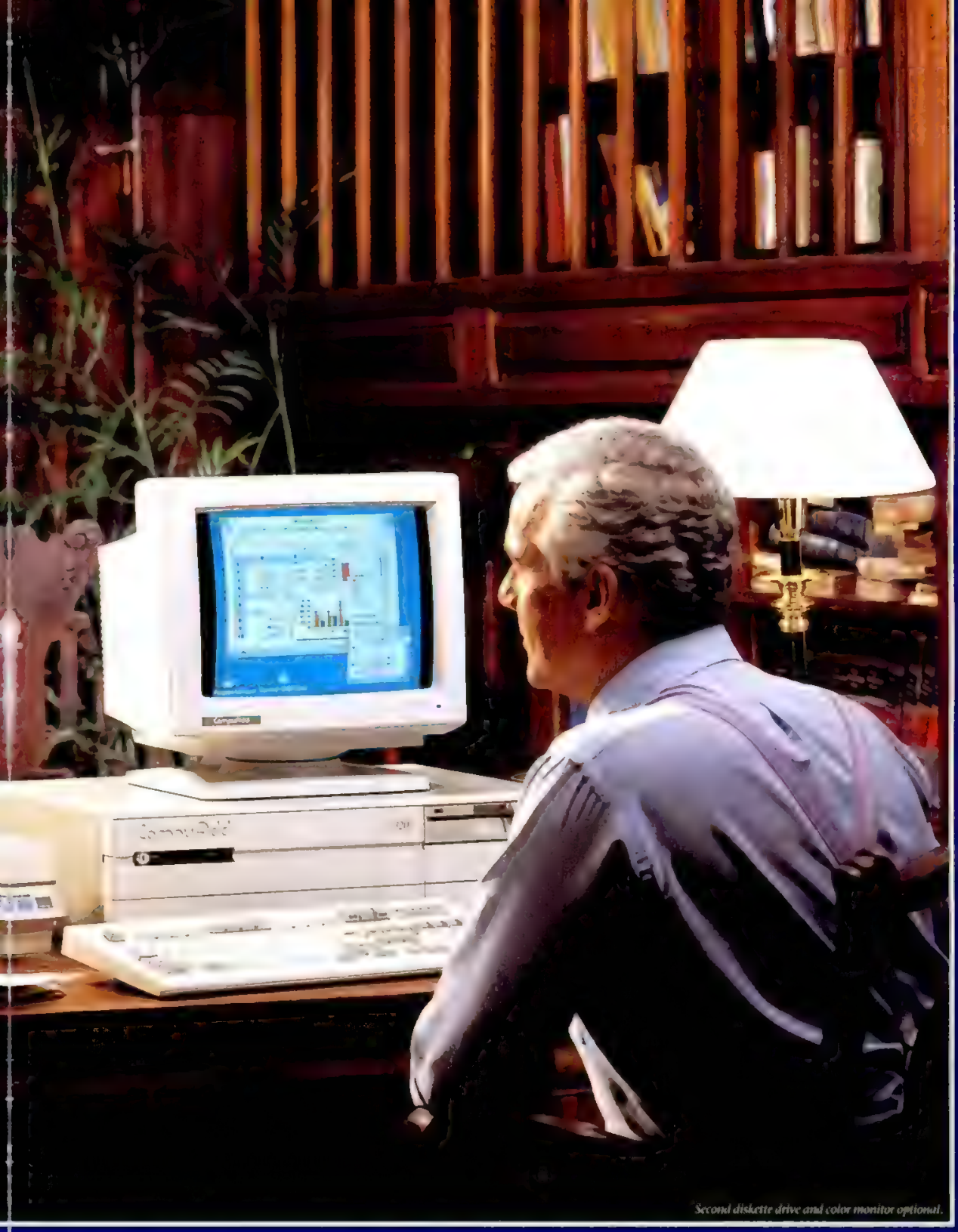

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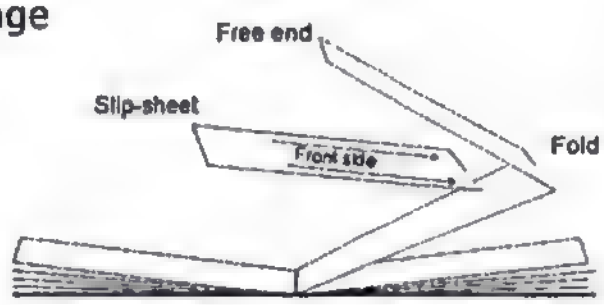
Folded edge of the page

GbsSlipSheet-001

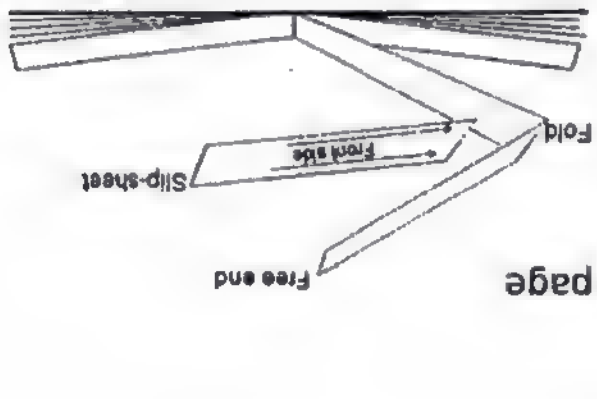
Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
   1. Front side touching the free page
   2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Inverted Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
   1. Front side touching the free page
   2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



GbsSlipBack-001B

Back

1. Follow instructions on the other side

Inverted Back

1. Follow instructions on the other side

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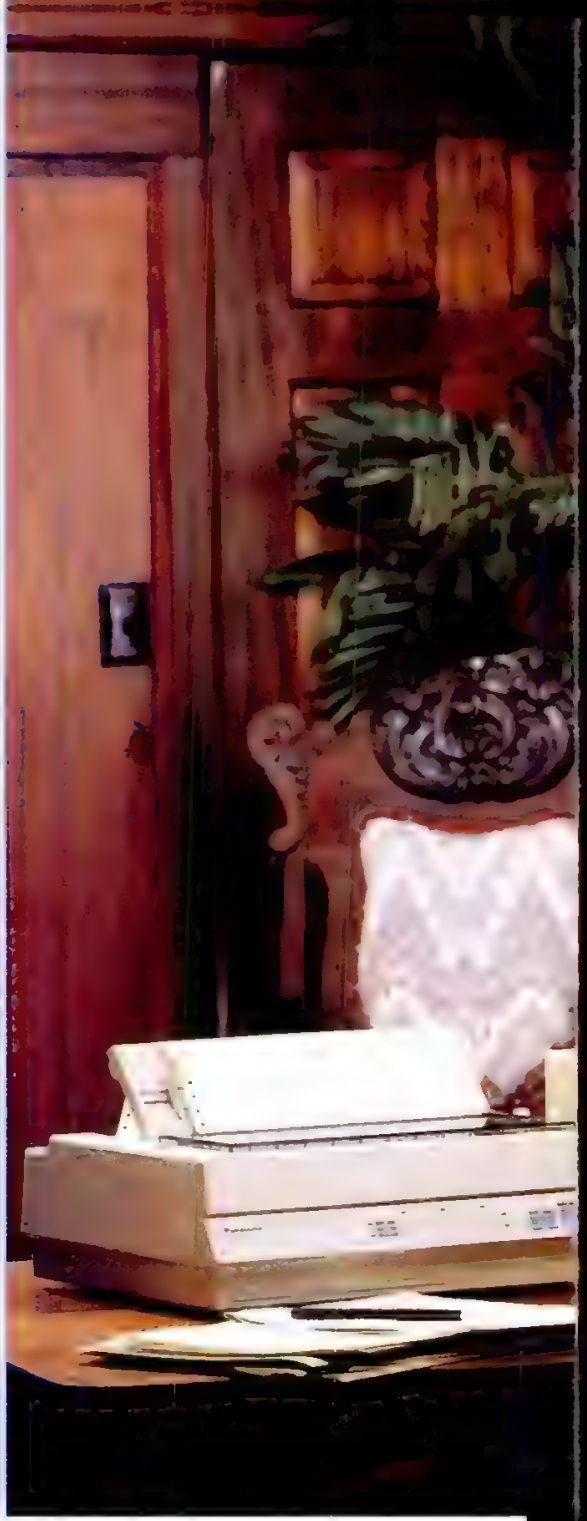

CompuAdd's NEW DX Success Kit Features:

- 80386 microprocessor running at 20MHz
- 1 MB DRAM expandable to 16MB
- 0 wait-state cache memory
- 40MB (28ms) hard drive
- 5.25" 1.2MB or 3.5" 1.44MB diskette drive
- Dual diskette controller
- Dual IDE hard drive interface
- Six 16-bit and two 8-bit expansion slots
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Part Number 66674

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- Dedicated 80387SX math coprocessor socket
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- Dimensions: 12.7" x 12.4" x 2.4"
- Weight: 11.5 pounds
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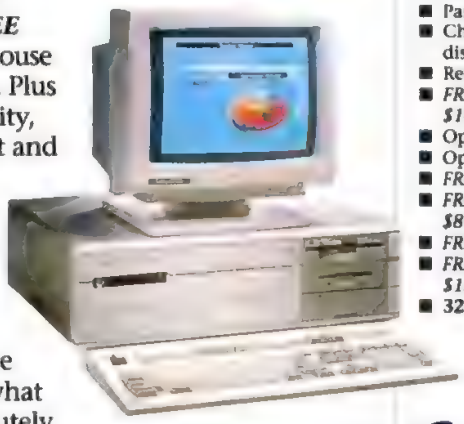
- **Kit Price: $3195** *(62203)* (Kit includes Diconix 150 Plus printer and 2400 baud modem/send-only fax.)

CompuAdd 325

CompuAdd's 325 gives you 25MHz 386 processing power at an unbeatable CompuAdd value price. Why pay almost $2000 more for Compaq's equivalent system, when you get so many extras with the CompuAdd 325? Extras like ***FREE*** CompuAdd Windows 3.0, ***FREE*** CompuAdd MS-DOS 4.01, a ***FREE*** mouse and ***FREE*** onsite service for one year. Plus you get CompuAdd-designed reliability, backed by toll-free telephone support and the convenience of 89 CompuAdd Superstores across the country.



With the CompuAdd 325, you'll master sophisticated applications such as accounting, database management, desktop publishing and CAD. Pick from a variety of hard drive and monitor options to get exactly what your work requires. When you absolutely cannot afford to be left behind in the information revolution, the CompuAdd 325 is the system solution!

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have to choose a separate option called "Proportional Laser Output." You may wish you didn't. To use this option, which supports PostScript but not the LaserJet III, you must give up most of your normal control over the printed result.

For example, the program automatically hyphenates and won't let you change hyphenation points or turn hyphenation off. You can't use proportional laser output for mail-merge; you can't have more than 60 footnotes or specify some layout features. A screen shows you what your pages will look like, but that doesn't help if you can't do much to change them.

With Proportional Laser Output, you specify line height in lines per inch (whole numbers only), because the program won't adjust automatically for different font sizes. The manual warns you that some PostScript characters will print in the wrong widths, that footnotes in tabular columns may print on the wrong page, and that you can't print graphics in proportional output unless you first print them with regular output. With all this to worry about, you may or may not be grateful for the copy of Bitstream *Fontware* included in the package.

MultiMate gives you an enormous number of options when you print, although most of them are probably better suited to a menu that sets permanent defaults. You get elaborate choices for print queuing, including the exact time to print.

SUITABILITY TO TASK

THE IDIOSYNCRATIC METHOD

MultiMate is incapable of removing zeroes from the numbers on its menus. If you want to print only through page 23 of a longer file, you'll have to replace the default final page 9999 with page 0023. When the speller has finished checking a file, it can't indicate that you misspelled 24 words but insists that you misspelled 000024.

The editing screen displays format codes as plain ASCII characters, but at least some of them are punning reminders of their meaning—a footnote, for example, is a musical note, and a nonprinting comment is a pair of exclamation points. Page breaks are indicated by ruler lines that look almost indistinguishable from tab rulers, which can be inserted anywhere you want to change format. You can easily waste time struggling to remove a page-break ruler with the same keystrokes you would use to remove a tab ruler. *MultiMate* doesn't let you simply delete either kind by backspacing over them, but forces you to use function-key maneuvers instead.

When you modify a ruler line you can't enter tabs or the right margin as numbers; you have to move the cursor space by space to the proper position. You reduce the right margin by holding down the delete key and removing spaces on the ruler. Fortunately, the program's macros include optional commands for moving the cursor a specified number of positions, and also for box drawing, pauses, and prompts. In earlier versions, *MultiMate*'s macro editor was virtually unusable. Now macros can be edited like ordinary files, as in *Word*.

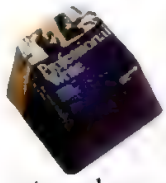
A BUNDLE OF EXTRAS

Like *WordStar*, *MultiMate* incorporates a version of *Inset* for graphics editing, but the two programs are badly integrated. When you insert a graphic you have to make space for it by hand. *MultiMate* also incorporates a version of the grammar checker *Grammatik IV*, which may be useful in corporate environments for homogenizing style and correcting punctuation errors.

Its built-in mail-merge includes simple programming. You can print or not print a field depending on whether its value is equal to, greater than, or less than a value specified, but you can't branch or create custom prompts or messages as you can in most rival programs. As you would expect of an Ashton-Tate product, *MultiMate* can merge from *dBASE* files, but it can't make direct use of spreadsheets.

MultiMate still has thousands of loyal users who have learned to love its endless menus and prompts and its cranky and inconsistent interface. For those users, Version 4.0 is a welcome upgrade packed with new features. Others may find it difficult to use, unappealing to look at, and short on features and conveniences.

Professional Write



Sometimes a ten-speed bicycle gets you there faster than a ten-wheel truck. If you use a word processor mostly to write memos, letters, and reports, and you want a quick and efficient system for form letters built in, *Professional Write* will give you almost everything you need. Software Publishing Corp.'s $249 executive word processor performs all its functions with clarity and elegance and combines simplicity and efficiency in a way unmatched by any other program.

If you can read a menu, you can probably use *Professional Write* without opening the manual. The program leaves out many of the advanced functions that no professional word processor should be without, but it includes a surprising number of features that users of those professional programs might envy.

REASSURING REALISM

Professional Write is designed for users who learned to write on a typewriter. The

Now that ev afford a Macintosh, whic

This is all of them. From left to right: The new Macintosh Classic, the well-established Macintosh SE/30, the Macintosh Portable, the new Macintosh LC, the new Macintosh

In 1984, Apple introduced the first Macintosh® on the simple premise that people shouldn't have to learn to work with computers.

Computers should learn to work with people.

Today, Macintosh is still the only computer system designed from the chip up on this principle.

Meanwhile, other computer companies are scrambling to make their conventional technologies emulate what is still unique about Macintosh.

But no other personal computer comes close to matching the Macintosh record of stability, consistency, and innovation.

At $999,* the computer people actually use can be used by a lot more people.

We're now introducing three new Macintosh personal computers. At prices that make powerful computer technology not only accessible, but affordable as well.

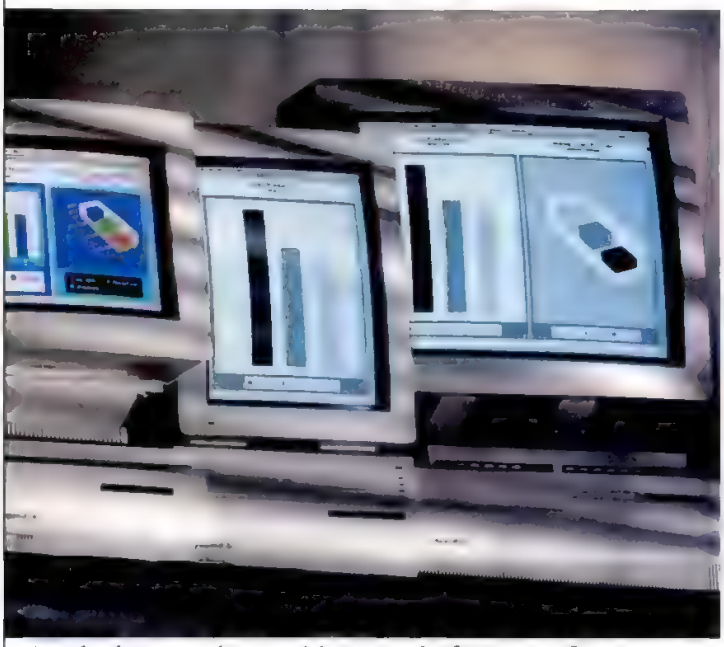
Together, they put much of the power and function of our most advanced computers into our least expensive ones.

The Macintosh Classic.®

It has everything that makes a Macintosh a Macintosh. Built-in networking. A SuperDrive™ disk drive, which reads both Macintosh and MS-DOS files. And a $999* price that includes the built-in monitor, 1MB of RAM, keyboard, mouse, and system software. The 40MB hard disk is optional. Its processor is an 8 MHz 68000 chip. And it outperforms even its popular predecessor, the Mac® SE.

The charts shown use figures included in a 1990 study conducted by Diagnostic Research, Inc. among Fortune 1000 MIS managers familiar with Macintosh and MS DOS or Windows systems. Call and we'll send you logo. Mac, Macintosh, and The power to be your best are registered trademarks, and SuperDrive is a trademark of Apple Computer Inc. MS DOS and Windows are registered trademarks of Microsoft.

erybody can h one should you afford?



IIsi, plus the Macintosh IIci, and the Macintosh IIfx. Have we left anybody out?

The Macintosh LC.

The new, low-cost Macintosh LC introduces exquisite Macintosh color and graphics to a wider world. With its 16 MHz 68020 processor, it runs all the thousands of Macintosh programs at impressive speed. And, with an optional Apple® IIe Card, it runs thousands more Apple II applications as well. The Macintosh LC expands by adding a card to its standard slot. A 40MB internal hard drive is standard.

A built-in video chip runs either an Apple monochrome or low-cost color monitor – without adding a video card. And the Macintosh LC, like the Mac IIsi, even lets you record your voice and other sounds into the computer. Which will soon make voice-annotated software a standard Macintosh feature.

The Macintosh IIsi.

Running a 20 MHz 68030 microprocessor, the Macintosh IIsi delivers serious number-crunching at the most attractive possible price.

Into its sleek package are compressed all the powerful essentials of the Mac II line. Including an optional 32-bit NuBus™ slot supporting high-performance graphics and accelerator cards. Along with advanced networking systems like Ethernet and Token-Ring. Plus a 40 or 80MB hard drive. Built-in video chips drive four different Apple monitors.

This is a family show.

In 1984, we offered only one Macintosh. As of today, you can choose from seven different models.

Although they include some of the most powerful personal computers ever made, they all run with the same point-and-click simplicity. The way a computer system should work, of course.

But Macintosh is still the only one in the world that works this way.

It doesn't cost anything to ask.

With one call, we'll get you to someone who will show you our most affordable new computers.

Just dial 800-538-9696, extension 350.

Now that everybody can afford a Macintosh, come in and find out why you're going to want one.

The power to be your best.

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PC MAGAZINE

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PC Magazine July 1990

Altec sets the standard for the highest quality design and manufacturing of all our products. We're fast, friendly, and ready to help you select the right features for your needs. Take a look at some of our other great systems:

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(25 Mhz Cache System $3395)
(64K Cache Version add $100)

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Intel 386-25 CPU □ 4 Meg RAM □ 1.2 MB 5 25" drive □ 1.44 MB 3 5" drive □ 105 MB IDE hard drive □ 16-bit VGA card □ 14" VGA monitor (1024 x 768) □ 2 serial, 1 parallel & 1 game ports □ 101-key Keyboard □ Genius Mouse □ MS-DOS 3.3 or 4.01

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Intel 386SX-16 CPU □ 2 Meg RAM □ 1.2 MB 5.25" drive □ 1.44 MB 3.5" drive □ 66 MB 25ms hard drive □ 16-bit VGA card □ 14" VGA monitor (640 x 480) □ 2 serial, 1 parallel & 1 game ports □ 101-key Keyboard □ Genius Mouse □ MS-DOS 3.3 or 4 01
(20 Mhz 386SX version add $150)

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CIRCLE 104 ON READER SERVICE CARD

IT'S NOT WHAT YOU SAY BUT HOW YOU SAY IT

by Rink Murray

Let's face it, good deeds often go unnoticed; bad deeds don't. In the business world, there are no guarantees that anyone will notice good writing, but you can be sure they'll notice when your writing is bad. Despite the abundance of features, word processors still cannot make you a good writer. Grammar-checking programs are designed to pick up the slack, but can they achieve the level of expertise that users expect?

With *Grammatik* (here in its *Windows* version), users can add or delete rules. In default mode, the package can't catch this "it's" error, but you can create a rule that will flag it. This kind of customization is beneficial to organizations that want to maintain a consistent style.

We wanted to see what the three leading grammar-checking programs—Lifetree Software's *Correct Grammar*, Reference Software International's *Grammatik*, and Que Software's *RightWriter*—could do in a real-life situation, so we wrote an abysmal business memo containing 39 errors involving grammar, style, and spelling. Then we let the grammar checkers do their stuff. To see how these programs fared against a talented human being, we also gave a copy of the memo to Glen Becker, *PC Magazine*'s copy chief, for his perusal—but did not tell him the real purpose of the task.

Of course, no grammar checker is as capable as a professional human editor. The packages exist to free a writer from worrying about typical grammatical errors so he or she can concentrate on content. Keeping this in mind, you'll find there is no contest when you compare a grammar-checking program's capabililites with those of a human.

Grammar checkers are great for catching certain kinds of errors with tremendous speed. To varying degrees, each package recognizes the passive voice, spelling mistakes, split infinitives, and run-on sentences. But no program caught more than half the errors in the memo. Our copy editor found and corrected all 39.

One of the grammar checkers' biggest weaknesses is the inability to interpret what they read. Language is dynamic, and when you place two words next to each other you can enrich or diminish the meaning of both words. For example, none of the grammar checkers suggested that the phrase "to increase shrinking sales" was awkward (if not contradictory). And all of the programs overlooked the sentence where the memo stated that there were two marketing strategies, then proceeded to list three. Also, while all three programs suggested "First" instead of "Firstly," none of them caught the inconsistency in a passage that said "Firstly... Second..." and so on.

AVOIDING CLICHES

None of the packages flagged "cat's meow" as a cliche or found our deeply buried misplaced modifier. And none of them noticed our inconsistent punctuation in the memo's header, or realized that "that" is not the same as "which," or that "less" is not "fewer."

And when the memo stated, "Due to there tiny size, Minitors are perfect, for both portable computers and very small people," all three packages caught "there," but none found the misplaced comma after "perfect." Nor did they realize that "for both" makes the rest of the sentence nonparallel and vague. By saying "for both portable computers" the memo seems to imply that there are two specific computers in mind. Subtle problems such as these elude the grammar checkers.

The main advantage these programs have over humans is speed, but some methods of grammar checking are faster than others. *Grammatik* moves you right along by showing you mistakes one at a time, letting you correct them if you wish, and then incorporating each change directly back into your word processor. *RightWriter* operates a different way, showing you all the errors in a document at the same time (you can scroll through), thus letting you see how changing one error might affect the entire document. You make all the necessary corrections, and *RightWriter* saves them into a new .CLN (for "clean") file and loads that file back into your word processor. More steps are involved, but some users may prefer this holistic approach. *Correct Grammar* operates in a fashion similar to *Grammatik*.

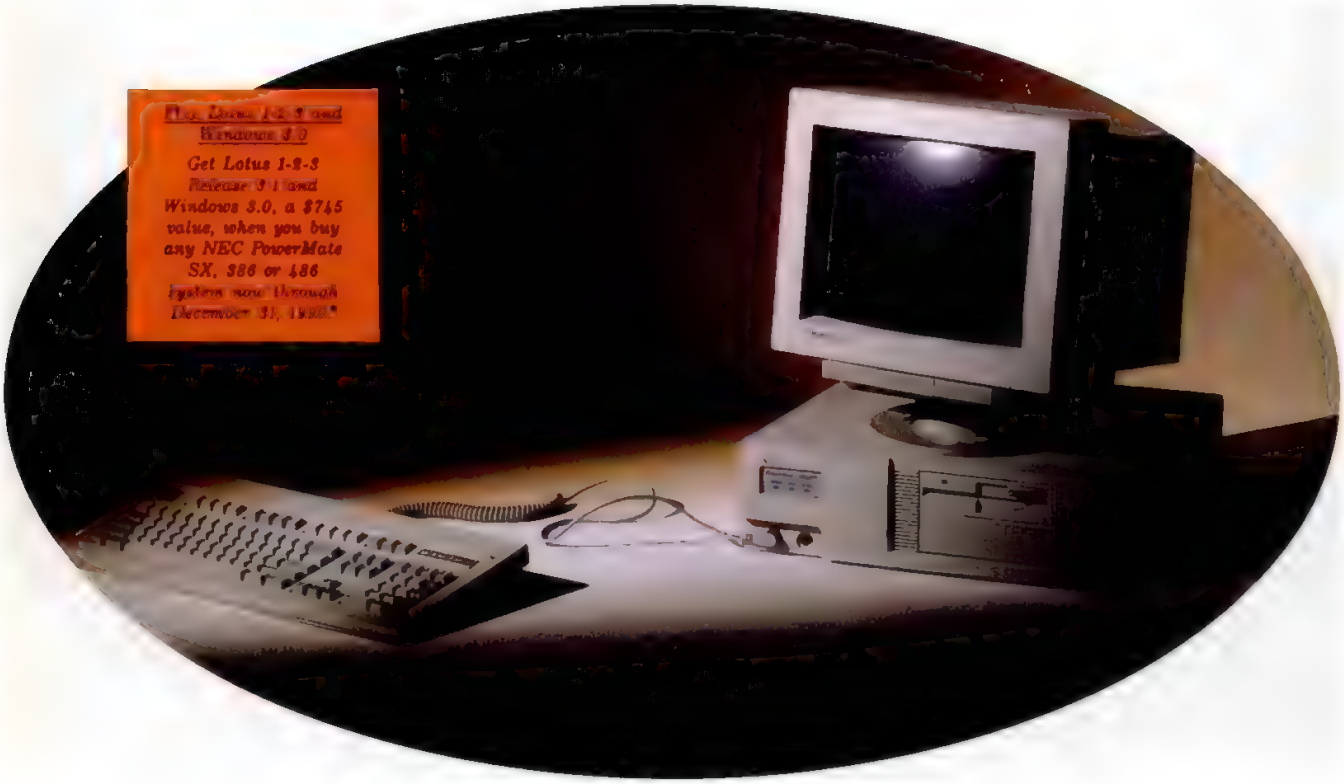
RightWriter correctly placed "who" and "there" on the suspicious-word list ("whom" and "their" were correct) but gave no clue as to why. A user seeing those words would probably ignore them just as I ignored "no, can't, vending, all, to, and if." The most annoying aspect of *RightWriter* is that in order to correct the document, you must either *manually* remove each one of *RightWriter*'s objections or work on the original document in a window.

MAKING CHOICES

All three programs caught roughly the same number of errors, but unlike *RightWriter*, both *Correct Grammar* and *Grammatik* let you correct errors without having to switch files around. Both

CONTINUES

How to make the work go faster and the money go slower.



NEC PowerMate 386/25S. The affordable entry to high performance 386 processing.

For advanced applications like CAD/CAM, presentation graphics or financial modeling, you can't go wrong with the PowerMate® 386™/25S. For far less than comparable 386 systems, you get 25MHz speed, 2MB of RAM (easily expandable to 16MB via SIM modules) and a 32K memory cache. You also get something you can't get from anyone else at any price: NEC. For more information call 1-800-NEC-INFO.

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ruler on the bottom line resembles the margin and tab ruler on your old Remington, and the editing screen displays the white space surrounding the text on the printed page, complete with headers and footers. When you type near the head or foot of a page, the bottom margin of the first page and the top margin of the next page fill much of the editing screen, but the reassuring realism may be a compensation for the waste of space.

Even the Tab key works the way it does on a typewriter: It moves the cursor over existing text instead of pushing text forward as in virtually all other word processors. If you want to push a column of text from one tab stop to the next, you can cut the rectangular block containing the text, move the cursor to the tab stop you want, and paste the block.

Block operations are especially elegant. When you finish defining the block,

IT'S NOT WHAT YOU SAY BUT HOW YOU SAY IT

CONTINUED

programs suggest corrections and provide on-line information about the errors. (Version 4 of *RightWriter* will include the ability to hotkey in and out of several major word processors, saving you a couple of steps.)

Not only did *Correct Grammar* and *Grammatik* catch most of the spelling errors in our test, they even learned new words as they analyzed the memo. They caught all "their/there" errors and flagged all instances of the passive voice. Only *Correct Grammar* caught incomplete sentences and "it's/its" errors. It also found more subject/verb disagreements than the other programs.

Grammatik's biggest flaw is that it doesn't rescan a sentence to see if your corrections make sense. However, unlike *Grammatik*, *Correct Grammar* twice missed a repeated word like "is is." *Grammatik* knew the difference between "who" and "whom," and it was also socially conscientious enough to recommend "salespersons" over "salesmen." And if *Grammatik* doesn't know a rule, you can teach it. For example, after I tinkered with *Grammatik*'s preference menu, the program began to alert me whenever it encountered "it's" or "its." *Grammatik* is bundled with *MultiMate IV* and *Professional Write*, and is the only grammar checker currently available in a *Windows* 3.0 version.

Technology has a habit of putting people out of work. In the grammar-checking arena, the competition between man and machine is not yet competitive, and Glen Becker need not worry about his job.

Are grammar checkers worthwhile? Yes, but realize there is much they cannot do. They won't make you a good writer, but they can teach you to avoid the mistakes you tend to make repeatedly. And for $100 or so, that service is certainly worthwhile. Copy editors don't come so cheap.

GRAMMAR CHECKERS: SOME SUCCESSES

	Correct Grammar	Grammatik	RightWriter	Glen Becker
Passive voice	■	■	■	■
Spelling errors:				
personel	■	■	■	■
unwilllingly	■	■	■	■
Minitores	■	■	■	■
Subject/verb disagreement (3)	■(2)	■(1)	❑	■
Missing word	❑	❑	❑	■
Misplaced comma (2)	❑	❑	❑	■
Misplaced hyphen	❑	■	❑	■
Misplaced modifier	❑	❑	❑	■
Redundancies (2)	❑	■	■	■
Double word (2)	❑	■	■*	■
Cliche	❑	❑	❑	■
Run-on sentence	❑	❑	❑	■
Fragment (2)	■(1)	❑	❑	■
Sexist language	❑	■	■*	■
Inconsistent verb tense	❑	❑	❑	■
Wrong word usage:				
affective	❑	■	■*	■
on	❑	❑	❑	■
there/their	■	■	❑	■
that/which (2)	❑	❑	❑	■
who/whom	❑	■	❑	■

■—Yes ❑—No

* *RightWriter* noted the word but did not specify the nature of the problem

***Correct Grammar*, Version 2.1**
Lifetree Software Inc., 33 New Montgomery St., #1260, San Francisco, CA 94105; (800) 543-3873, (415) 541-7864.
List Price: $79.
Requires: 460K RAM, 1.2MB hard disk space, DOS 2.0 or later.

CIRCLE 398 ON READER SERVICE CARD

Grammatik IV
Reference Software International, 330 Townsend St. #123, San Francisco, CA 94107; (415) 541-0222.
List Price: *Grammatik IV* or *Grammatik for Windows*, $99; five-user business pack (network or standalone), $245.
Requires: 1MB RAM, *Microsoft Windows* 2.11 or later; for character-based version, 512K RAM, DOS 2.0 or later.

CIRCLE 399 ON READER SERVICE CARD

***RightWriter*, Version 3.1**
Que Software, 11711 N. College Ave., Carmel, IN 46032; (317) 573-2500.
List Price: $99.
Requires: 512K RAM, DOS 2.0 or later.

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Rink Murray is an assistant editor of PC Magazine. ■

My network keeps cutting

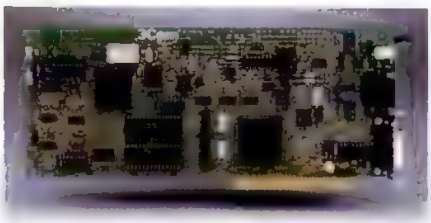
Now what?

Of all the crazy problems that come across your desk each day, a network adapter board failure has to rank near the top.

First of all, it shouldn't happen. Adapter boards should be reliable hardware and the bugs should have been worked out of them long ago. Second of all, like most network problems, adapter board failures cause a disproportionate amount of pain.

Why is the new VP suddenly off the network? Where do I start?

No adapter board is worth this trouble. So, many people never take the risk. They use 3Com EtherLink® adapter boards.



Right now, there are 1.5 million 3Com boards installed around the world. IBM, Apple, Hewlett-Packard and Sun buy them from 3Com to resell with their

off the new guys in finance.

products, to name just a few.

3Com boards come with a 3-year warranty, and are made in the United States at the same campus where the people who designed the boards work.

There are 3Com adapter boards available for the IBM® PC, PS/2® and compatibles, the Apple® Macintosh® and 10BASE-T versions for the IBMs. And more software has been written to run on 3Com adapters than any other. So compatibility shouldn't be a problem.

But that's only part of the story.

To learn more, just call 1-800-NET-3Com Dept. D3612 to receive an EtherLink product brochure. You'll also receive a free guide showing you ways to grow your network. At 3Com we make internetworking products and wide area networking products, as well as servers and operating systems to help you network more types of systems to more types of systems. Because what good is reliability at one end of the network if you can't rely on the rest of it as well?

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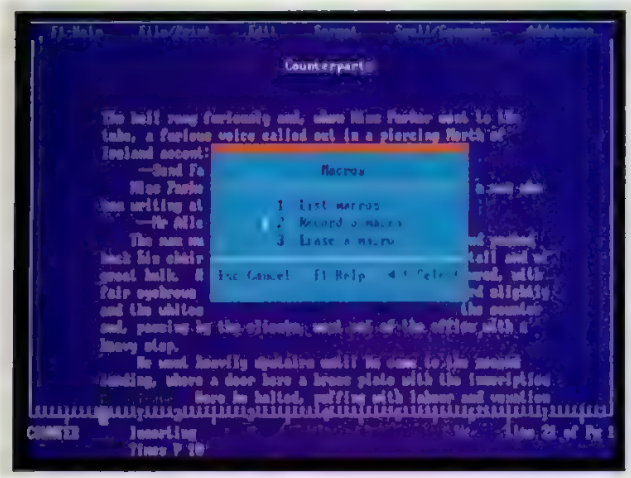
a menu pops up with a list of things you can do with it, ranging from standard cut-and-paste to changing the font, text attribute, or margin and tab settings. You can also save the block as a file, optionally encrypted like any *Professional Write* file. Or if the block contains numbers, you can transfer them to a pop-up calculator that lets you paste the result of arithmetic operations (including averaging) back into the text. If the block consists simply of a series of numbers without arithmetic operators, the calculator is smart enough to put plus signs between them. You can change these to other operators in the pop-up screen.



All of *Professional Write*'s options are available from a menu. When you are editing, options at the top of the screen have function keys listed. Here, when you prepare to record a macro, only "F1 Help" is available. The margins represent the typewriter page, and the ruler on the bottom remains visible.

WELL-IMPLEMENTED FUNCTIONS

Professional Write keeps a list of function keys at the top of the screen to indicate how to access a set of well-designed menus. Clear, context-sensitive help is always available by pressing F1, and the help window lets you see much of the screen beneath. Most of the menu items have Ctrl-key equivalents, and virtually every option in the program (except some obscure commands that you can insert directly in a document for overriding automatic formatting) is available from the menus. The obscure commands are described in the help screens.

Among the well-implemented functions that you may not expect to find in a program of this class are a spell-checker, a thesaurus, and cursor line-drawing. (The diagonals don't look very smooth because they're made with line-draw characters unless you specify something different.) You can import standard spreadsheet files or named ranges from them. Like *MultiMate*, *Professional Write* incorporates the grammar-checker *Grammatik IV*, but in a much more sleek and sensible way. *MultiMate* slowly loads the *Grammatik* module, then gives you options to insert placemarks in your file or pause and edit. However, it doesn't let you move very far around the file until you exit grammar checking.

Professional Write, in contrast, instantly starts checking, pops up a screen with suggestions, and allows you to edit the text. It doesn't offer the option to litter your file with placemarks that you don't need. You can easily record macros with built-in pauses for input, and all your macros are listed on a menu. You are able to import graphs, but only from *Harvard Graphics* or other Software Publishing programs.

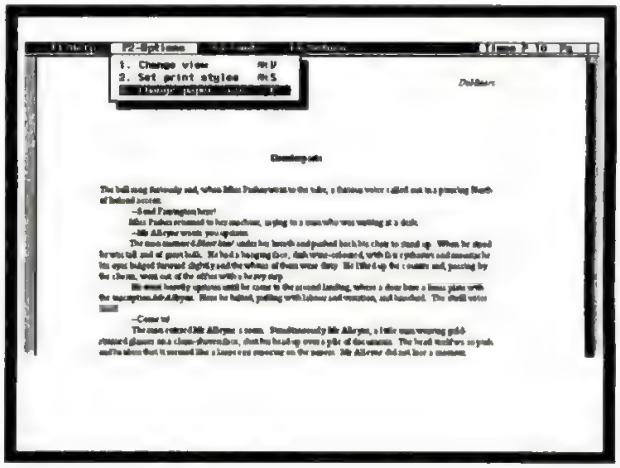
Professional Write includes an ingenious page preview that lets you change fonts and immediately see the result. Because the program's editing screen assumes that you are printing in a fixed-pitched font, you have to go to the preview screen to see where line and page breaks will occur if you use proportional fonts and want them spaced properly. If you don't like the look of the parts of your file that are in Times Roman 10, you can switch one or more of those areas into Helvetica 12.

You can use any standard LaserJet cartridge and the most common soft fonts, and you can use built-in PostScript fonts. Scalable PostScript and LaserJet III fonts are supported, but only in a few preselected point sizes. Unfortunately, the program supports only single or double line spacing at six lines per inch, so most proportional fonts will print with awkward leading.

One of the function keys on *Professional Write*'s menu takes you to a built-in address database with preset fields. You can transfer an address directly to a file, and the program can automatically lift the address from the file and print it on an envelope. You can also merge-print envelopes from the address database, or use the database for any other merge-printing. *Professional Write* can also use data from *dBASE* or *Professional File* and display a menu that lists the field names from the database. Here you can enter codes for selecting or sorting records and even tell the program to insert a field from the database to an unmatched field identifier in your merge document.

ODD LIMITATIONS

Not everything in *Professional Write* is convenient. You can't simply turn on underlining or italics but must mark a block of already entered text and choose the new text attribute from a menu. You can underline or bold individual words with a Ctrl-key combination, but the spaces between the words won't be underlined



***Professional Write*'s print preview is remarkably flexible for an executive-level word processor. You can switch between full-page and partial-page views, and you can make global changes to fonts without returning to the editing screen.**

DOS

stroke stroke stroke
stroke stroke stroke
stroke stroke stroke
stroke stroke stroke
stroke stroke stroke
stroke stroke stroke

Direct Access™

stroke

Here's a hardworking menu program that really lowers your handicap.

Getting into the programs on your hard disk with DOS commands can take longer than a foursome full of beginners. You should be using Direct Access.

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It's simple.

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PC Magazine's Editor's Choice

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1. It's pretty obvious from the specs on the opposite page that the Dell™ 316SX will deliver all the power you need for 32-bit computing. And it will do it for the kind of price you might expect to pay for a 286 machine. But there are some other things you might want to consider before you make up your mind.

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3. The Dell 316SX is also made by the company that has been rated #1 in eight *PC Week* customer satisfaction polls of corporate volume buyers for PCs.

4. A company that has won more than 40 worldwide awards for technical innovation and excellence.

5. When you deal with Dell you'll talk to knowledgeable sales people who not only understand in depth the products they sell, but will also give you clear and concise answers to your questions you'll get the help to decide exactly what configuration will best meet your needs.

6. Once you've decided what you want, your machine is individually assembled, with a complete system unit "burn-in." Then it must pass nearly two dozen extensive reliability checks before we let it out the door.

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AD CODE 11B88

*Performance Enhancements: Within the first megabyte of memory, 128 KB of memory is reserved for use by the system to enhance performance. Can be optionally disabled.

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PERFORMANCE TESTS: WORD PROCESSORS

LABS

Most professional word processors, even *Windows*-based packages, don't slow you down with performance problems. Isolated trouble spots exist, but none are serious.

The **Document Load** test measures the time required to bring in the 100K test file from the hard disk and have the word processing software load it into to the package's editing mode. Timing starts when the key is pressed to begin the import and ends when the file is on the screen.

In the **Save and Continue Edit** test, the file is saved to the hard disk while it is being edited. Timing starts at the moment the command to save is executed and ends when keyboard control is regained.

The **Program Load** test times how long it takes to load the word processing program from the hard disk, from the moment the Enter key is pressed at the command line (with no parameters active) to the moment that keystrokes can be entered in the program.

The **Save and Clear Screen** test adds a space to the beginning of the file, then saves the file and blanks the screen. Timing starts with the keystroke for saving the file and ends once the screen is cleared and the command line or menu is displayed. The space is added to make sure that "smart" programs (which can save faster when they detect that a file is unchanged) do not have a performance advantage.

The **Global Search-and-Replace** test performs an automatic search-and-replace to locate 100 occurrences of a word in the test document and replace each occurrence with another word. Timing begins on execution of the search and ends with the last replacement.

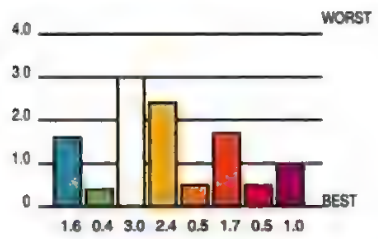
The **Search for Middle** test marks the middle of the document with the string "This is the Middle of the File," then searches for the string from the top of the file. Timing begins with execution of the search and ends when the string is located.

The **Top-to-Bottom Scroll** test times a scroll through the entire 100K document from top to bottom. For *Windows*-based programs, the scroll command is issued by placing the cursor on the Scroll Down button in the Vertical Scroll bar. For character-based programs, the Down Arrow key is held down. Timing starts when the mouse button or arrow key is pressed and stops when the end of the file is reached.

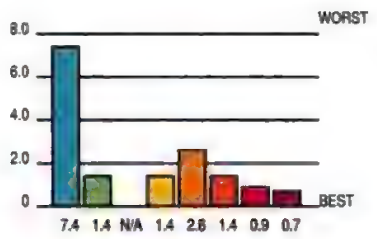
The **Merge Text** test inserts a 3K file into the middle of the main 100K document. Timing starts when the block is posted and stops when control of the keyboard is regained.

In the **Regain Keyboard Control After Print Command** test, the file is printed, and the delay is timed from the keystroke that executes the print command to the moment when control of the keyboard is regained.

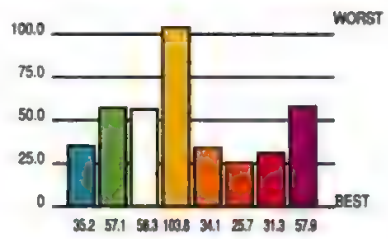
Document Load



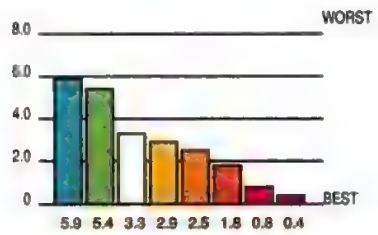
Save and Clear Screen



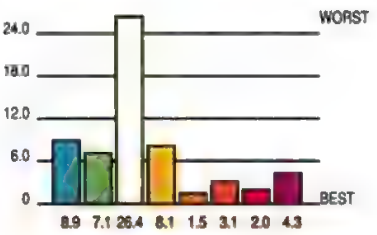
Top-to-Bottom Scroll



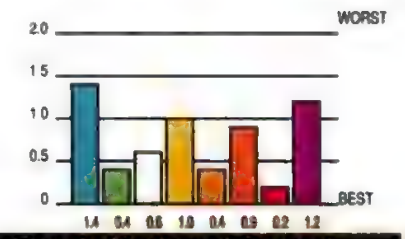
Save and Continue Edit



Global Search-and-Replace

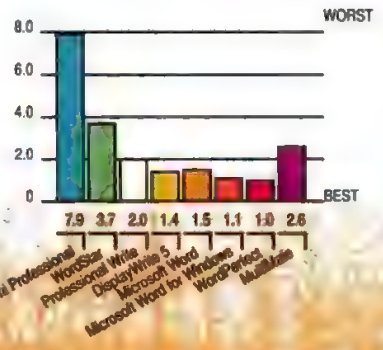


Merge Text

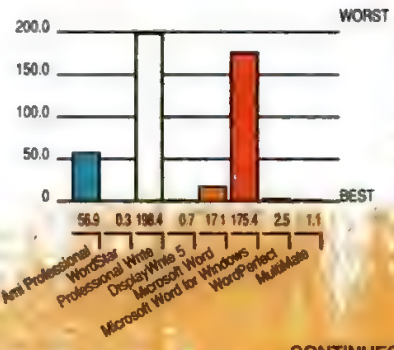


Program Load

Search for Middle



Regain Keyboard Control After Print Command



N/A—Not applicable: *Professional Write* could not complete this test with a single command.

CONTINUES

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Powerful, 32-bit performance. A compact, smart design, with plenty of room for expansion. Plus top-notch reliability, backed by a free, one-year, on-site warranty. All at a price that makes our competition's heads spin.

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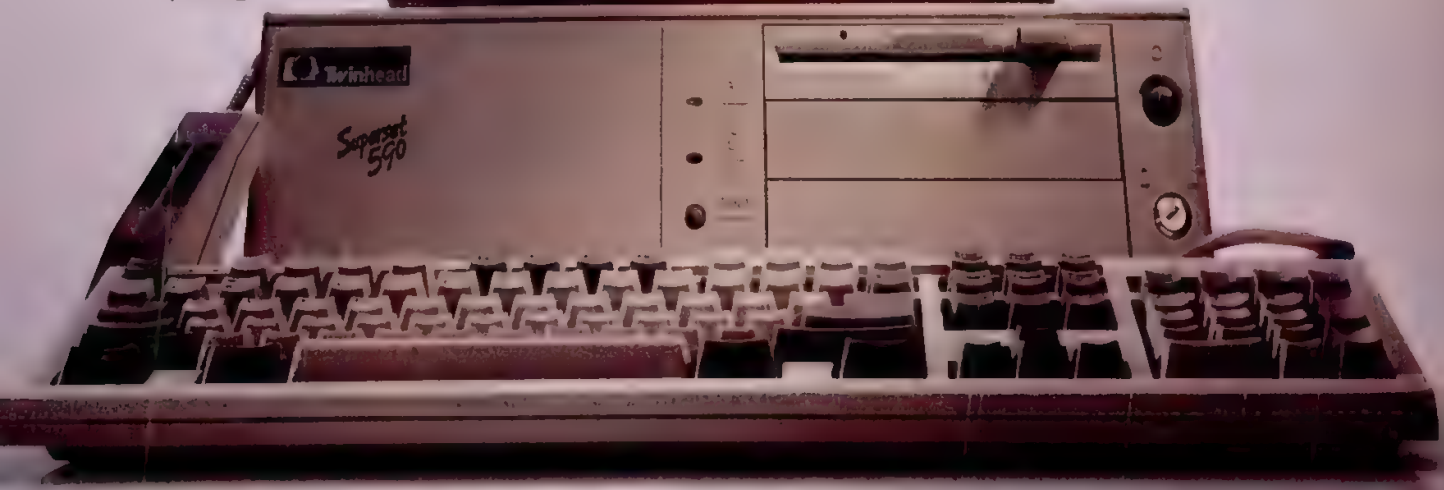

Superset-590/20 Features: *20-MHz 386SX processor; math coprocessor socket; 1-MB RAM, expandable to 5 MB; Super VGA graphics adapter; 3.5- or 5.25-in. floppy drive; 1 parallel, 2 serial ports; four 16-bit expansion slots; AT-IDE Hard Disk Drive Interface; 101 key keyboard; mouse; MS-DOS 4.01 (monitor not included). Options: 40 or 100 MB HD; VGA monitor; Microsoft Windows™ 3.0.*

*Promotional offer good for systems listed above between December 1, 1990 and January 31, 1991. One claim per company site or individual.**Competitor's system must be purchased within two weeks of previewing the Twinhead Superset-590/20. Twinhead dealers must date and sign claim form as proof of participation. For claim forms and contest rules, call the toll-free numbers below. All products or brand names are trademarks of their respective companies. Copyright 1990, Twinhead Corporation. All rights reserved.

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WORD PROCESSORS: COMPOSITE VIEW

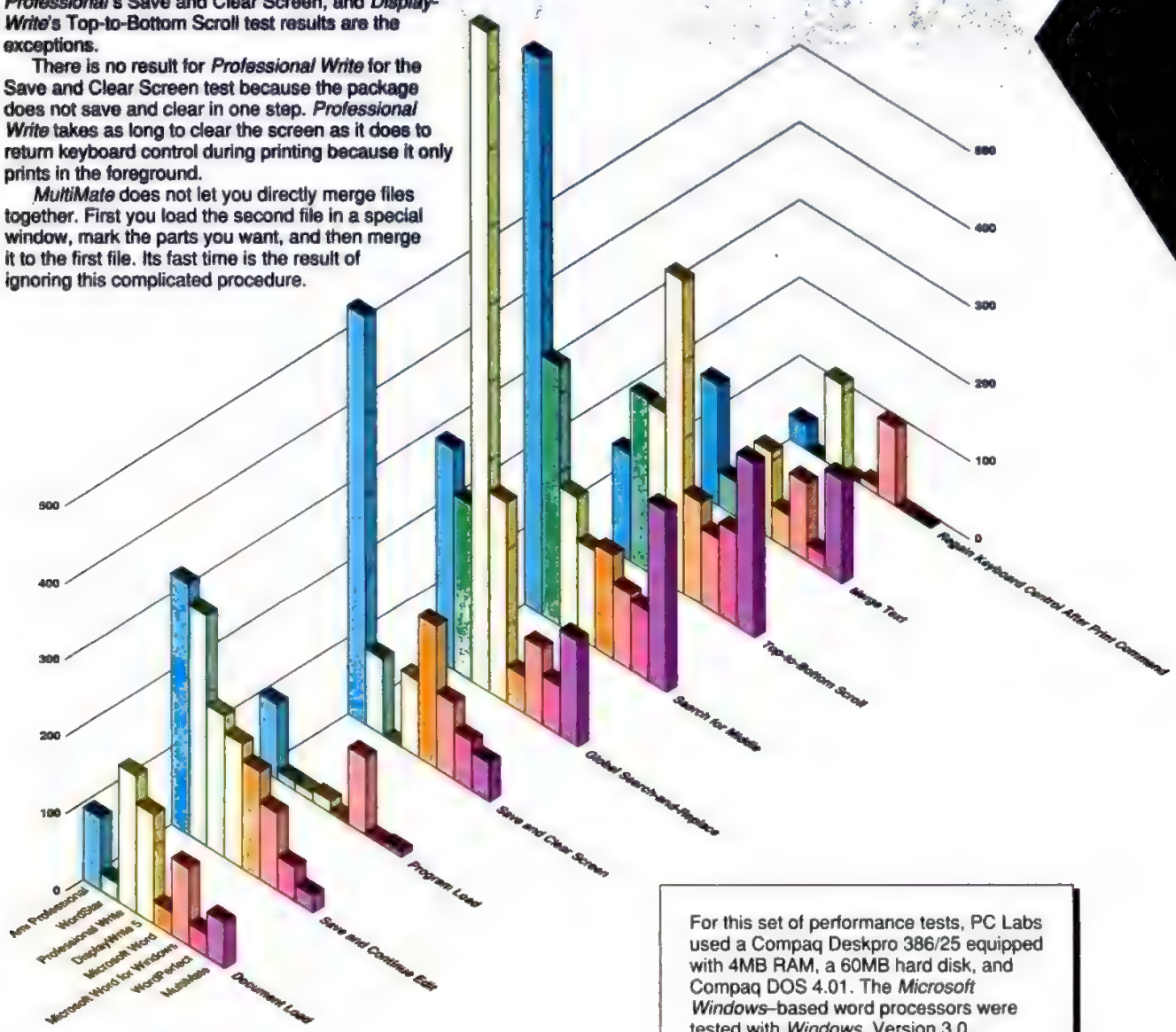
Though *Ami Professional* is slowest on four of these nine tests, it's interesting to note that the two *Windows*-based word processors (*Microsoft Word for Windows* being the other) aren't painfully slower than their character-based competition.

Despite the doubling of our test file size from 50K to 100K, all of the word processors performed most functions sufficiently quickly. *Professional Write*'s Global Search-and-Replace function, *Ami Professional*'s Save and Clear Screen, and *DisplayWrite*'s Top-to-Bottom Scroll test results are the exceptions.

There is no result for *Professional Write* for the Save and Clear Screen test because the package does not save and clear in one step. *Professional Write* takes as long to clear the screen as it does to return keyboard control during printing because it only prints in the foreground.

MultiMate does not let you directly merge files together. First you load the second file in a special window, mark the parts you want, and then merge it to the first file. Its fast time is the result of ignoring this complicated procedure.

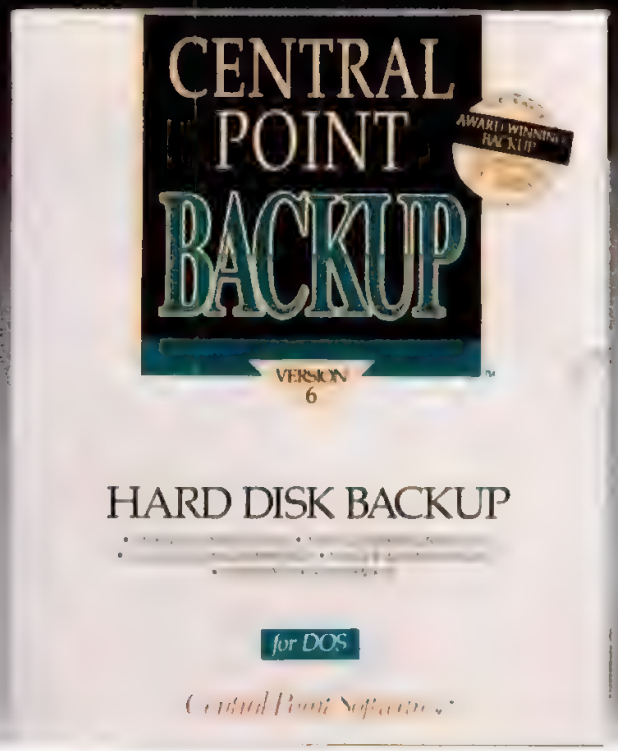
Relative Times
(*Microsoft Word for Wi*

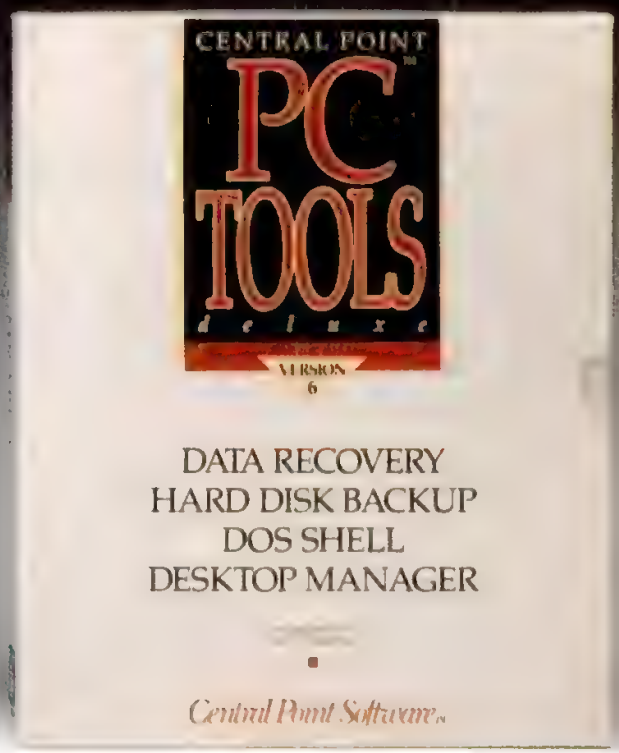


For this set of performance tests, PC Labs used a Compaq Deskpro 386/25 equipped with 4MB RAM, a 60MB hard disk, and Compaq DOS 4.01. The *Microsoft Windows*–based word processors were tested with *Windows*, Version 3.0.

We ran the tests three times, clocked the test runs with a stopwatch, averaged the results, and rounded the score to the nearest second. Average times of less than a second were rounded up to 1. The test file was 100K in size.

ENDS





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BACKUP TIME

	InfoWorld	NSTL
Central Point Backup	7:00	2:03
Fastback	9:17	2:43

InfoWorld tests on an Intelligent Data Systems PC-286 AT; National Software Testing Laboratories used a Compaq Deskpro 286s.

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Either way, you end up with the backup program that's already the leader.

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SUITABILITY TO TASK

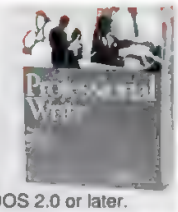
unless you underline a whole block of words at once. Oddly, you can't close up the space between the word at the end of a line and the word at the start of the next with the Backspace or Del key; you must insert or delete enough text to move the two words to the same line, where you can delete the space between them.

You can't change default margins or tabs, but you can save a blank formatted file as a template for other files. You can only print in the foreground, so prepare to get a cup of coffee instead of going back to work when you print a long file.

When you retrieve a file created by another word processor—most major formats are supported—*Professional Write* tends to leave hard returns in place of the soft returns in the original file. You'll have to fix the file manually because the search function can't find or replace a return character.

Professional Write doesn't support footnotes, nonprinting comments, columns, or other advanced format features. More surprisingly, it doesn't come with an installation program. If you use it on a hard disk, you have to create a directory and copy the files manually. This omission can leave a bad initial taste in the mouths of the computer novices for whom the program is designed. But once you get started, you'll find very little to complain about in this compact and well-designed package.

FACT FILE



***Professional Write*, Version 2.2**
Software Publishing Corp., P.O. Box 7210, 1901 Landings Dr., Mountain View, CA 94039; (415) 962-8910.
List Price: $249.
Requires: 512K RAM, DOS 2.0 or later.
In Short: One of the simplest to use of all word processors, *Professional Write* comes with an address book built in and, for a personal/professional-class program, provides strong printer support, including automatic envelope printing. Its functions aren't in the league of corporate-class programs, and reefs of inconvenience intrude on its sea of simplicity, but *Professional Write* offers surprisingly easy sailing.

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WordPerfect

If there's anything you want a word processor to do, you can be confident that *WordPerfect* will do it, and probably do it brilliantly. Version 5.1 of WordPerfect Corp.'s $495 flagship dominates the market through a unique combination of features, conveniences, and support. From the outside, WordPerfect's method looks simple: Offer a program that beginners can manage but that has a depth of functions that can keep experts busy for years, works with every printer and monitor in the known universe, and gives your users knowledgeable, toll-free support. It looks simple, yet no one except WordPerfect has figured out how to do it.

Large and powerful as it is, *WordPerfect* 5.1 feels fast on its feet. Its multitude of features are better integrated and more consistent than any rival package, so it is easy to learn, despite a default interface that uses arbitrary function keys. If you don't like the function keys, pull-down menus are available, and you have a choice of which keystroke to use to open the menu system. If you're stumped by some of the functions hidden in the depths of the program, detailed context-sensitive help is a keystroke away.

If you haven't looked at *WordPerfect* for a few years, you've missed out on the most flexible table editor in a character-based word processor, a powerful equation editor, rudimentary mouse support, and advanced document management with multifile searches and optional long names for files and even directories. As in earlier versions, you edit text on a clean screen. When you want to edit format and other codes, you still open a cluttered, ugly "reveal codes" window in the lower part of the screen.

Keyboard shortcuts simplify operations that used to force you through multiple menus. *WordPerfect* still doesn't have collapsible outlines and still allows you to open only two windows at one time (although you can view a third file from the file-management menu). Mail-merge is now highly programmable and lets you ignore the obscure codes required in older versions.

WordPerfect can now import or build "warm" links to spreadsheet files (including .WK3) and most graphics formats. Spreadsheet import produces beautifully formatted results, and you can choose named ranges from a menu. Graphics can be resized, rotated, or rescaled within *WordPerfect*, but if you have the *Shell* program in the $149 *WordPerfect Office* package, a single keystroke lets you jump directly from *WordPerfect* to the graphics editor in *DrawPerfect*. Here

FACT FILE
EDITOR'S CHOICE

***WordPerfect*, Version 5.1**
WordPerfect Corp., 1555 N. Technology Way, Orem, UT 84057; (801) 225-5000.
List Price: $495.
Requires: 384K RAM (512K recommended), DOS 2.0 or later. Mouse optional.
In Short: *WordPerfect*, now virtually the unchallenged corporate and professional standard, boasts more features and conveniences than any other word processor, and its optional menu-driven interface also makes it one of the easiest to use. *WordPerfect* doesn't offer collapsible outlines, and its stylesheets are implemented awkwardly, but almost everything else is state-of-the-art—including fully programmable mail-merge and links to automated document processing and electronic mail through the *WordPerfect Office* package.

CIRCLE 407 ON READER SERVICE CARD

Large and powerful as it is*, WordPerfect *5.1* *feels fast on its feet. Its multitude of features are better integrated and more consistent than any rival package.

Another page in printer history.

PC MAGAZINE
EDITORS' CHOICE
November 13, 1990
Canon BJ-10e

Introducing the first printer that is both a desktop and a portable and prints with letter-quality precision on plain paper: The Canon BJ-10e Bubble Jet.™

On a desk, with its optional 30-sheet paper feeder, it's an ideal personal printer. As a single-sheet portable with its optional rechargeable battery pack, it weighs a remarkable 4.6 pounds and prints on a variety of paper. Moreover, the BJ-10e emulates the IBM® Proprinter™ X24E, so you can use a wide range of applications software.

How fast is it? It prints 83 characters per second and won't slow down when printing in bold or various type sizes. It even handles complicated graphics such as the scanned-in image printed here. And, it's so quiet it can be used in the middle of the night with someone asleep just a few feet away.

Plus you never have to worry about maintenance because it uses an economical pop-in BJ cartridge, containing the print head and ink supply, which prints approximately 700,000 characters (HQ mode). But best of all, the BJ-10e works everywhere you could possibly need it, fitting neatly into a briefcase.

The BJ-10e Bubble Jet. What other printers print on a desk, it prints anywhere.

The document displayed in the BJ-10e is actual output using the UltraScript™ pc software BJ-130e™ printer driver

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IBM® is a registered trademark and Proprinter is a trademark of International Business Machines Corp.
UltraScript is a trademark of QMS

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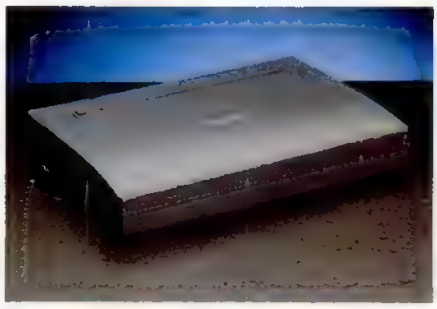

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BJ-10e
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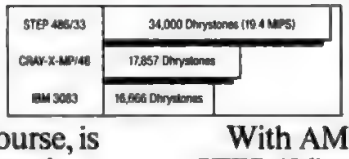
See Us at Fall COMDEX
Booth #1458

The Joneses.

Check out the benchmarks. When it comes to speed, pure and simple, mainframes are no longer the main attraction.

Introducing the Everex STEP 486/33 and STEP 486/25. Along with the STEP 486*is*, they give you desktop performance that was previously unheard of.



There are two reasons. The first, of course, is the 486™ chip. The other is AMMA,™ Everex's proprietary Advanced Memory Management Architecture.

AMMA uses "write-back" cache technology instead of the "write-through" technologies used in most PC's. The write-back cache was developed for mainframes. Everex was the pioneer in developing it for the PC. And in doing so, opened a whole new dimension in desktop performance.

With AMMA, you can write directly to the STEP 486's cache in nearly all cases. With write-through techniques, on the other hand, you lose most of the performance benefit of the cache.

*Inquiries from outside the U.S. call 415-498-1111. EVER for EXcellence is a registered trademark and Everex, STEP, STEP 486*is*, AMMA and PDS are trademarks of Everex Systems, Inc. 486 is a trademark of Intel Corp.

And how to keep up with them.

That's because write-through forces you to write to main memory much more often. And main memory is slower than the cache.

This is especially important in 486 computing, where the CPU performs as many as four times the write operations as in 386. Which makes AMMA's write-back architecture, combined with the 486's embedded cache, a powerful combination indeed.

But the STEP 486 machines give you more than just speed. They come with Programmable Drive Select. If your drive isn't listed on the set-up table, PDS™ lets you custom-configure the BIOS. It's good for virtually any hard drive.

What's more, all STEP systems come with a one-year extendable warranty and a one year renewable on-site service contract that also covers all Everex peripherals in the system.

To find out more, call 1-800-334-4552* for the name of your nearest Authorized Everex Reseller—every one a high performance expert.

Then you can let the Joneses try keeping up for a change.

EVEREX

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THE IRS IS A GIANT. HERE'S YOUR SLINGSHOT.

TurboTax®. It's *PC Magazine* Editor's Choice Award Winner for best tax software. It's also the number one selling tax preparation software. To pick up a copy, drop by your software store, or call us at (619) 453-8722.
Your money's on the line, so choose your weapon carefully.

ChipSoft

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CIRCLE 348 ON READER SERVICE CARD

you can edit the contents of the graphic itself, and then jump back to *WordPerfect* where you see the results of your editing already in your file. Hundreds of clever conveniences are hidden in the thousand-page manual: For example, you can automatically create dot leaders by pressing the key for center or flush-right twice.

DTP RIVAL

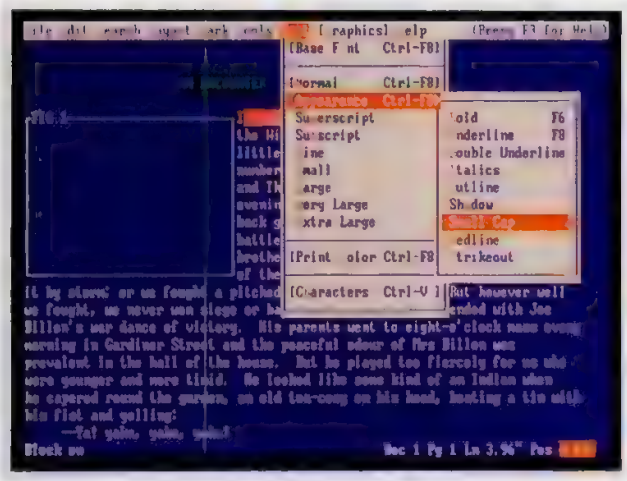
No other word processor—and, surprisingly, no desktop publishing program—gives you the same power over your printer that you get from *WordPerfect*. This power includes a fast print preview with enlarged views of the page and no special installation routine. If your printer supports graphics, you can print more than 1,600 characters (1,800 if you have PostScript-style dingbats), and you don't have to keep track of which character is included in your fonts; all except the PostScript dingbat characters appear in the preview screen.

On the editing screen, EGA, VGA, and Hercules Plus systems can use varying screen sizes and can display 512 characters. A forthcoming screen font editor add-on will let you select which characters you want. *Nota Bene* still offers superior support for extended multilingual typing but only for a limited number of printers.

WordPerfect lets you specify fonts either from a font menu where you choose a name and size, like Times Roman 12, or by selecting a customizable relative size (ranging from Fine to Extra Large) that lets you switch all fonts in a file when you switch the default font. So if you change the default from Helvetica 10 to Palatino 14, all fonts specified by relative sizes will change both style and size in proportion.

Fine adjustments in letter and word spacing, and other advanced typographic controls, are child's play, and if your printer supports color (including color PostScript) or rotated and shaded text, so does *WordPerfect*. Using a supplied menu-driven utility for modifying printer drivers, you can control even the most arcane printer functions. For example, if your eye tells you that the LaserJet puts its underline too close to the text itself, *WordPerfect* lets you override the LaserJet's default setting and move the underline a fraction of a millimeter down.

For more-mundane functions, you'll be grateful for the chance to print odd or even pages, and to speed up printing by sending data directly to the hardware rather than through the BIOS or by making the printer create multiple copies rather than waste time while the program does it. When you change printers, *WordPerfect* automatically switches printer ports, page size options, and even the default font.



WordPerfect's new pull-down menus—an optional alternative to the standard function-key interface—let you choose all program features with first-letter shortcuts. Graphics are displayed on the editing screen in blank boxes.

HIDDEN COMPLEXITY

You can build documents of exceptional complexity under *WordPerfect*'s smooth control. Automatic cross-referencing, paragraph numbering, and footnoting give you options scarcely suggested in the manual. For example, you can make lists numbered E1, E2, and so on and use any custom set of symbols for footnote references. You must issue a command to update cross-referencing, but if you try to print without updating, *WordPerfect* warns you first.

Although *WordPerfect* makes it all feel easy, you perform some very complex operations when you create even a simple document. A document carries your default program settings and its stylesheet (if you use one) with it, so that it will look virtually identical when it's loaded into someone else's copy of *WordPerfect*. It also carries detailed information about fonts and graphics so that a close approximation will print on someone else's printer, even if you created the document for a PostScript printer but have to print it on a lowly dot matrix.

SUITABILITY TO TASK

THE ASCENT TO 5.1

Over the years, *WordPerfect* has grown to seem more like a complex society than a mere program. Some parts of it have evolved more fully than others. The column menu still makes you enter the exact widths of customized columns and gutters and makes you start working before it lets you see the result. In contrast, the new table editor lets you adjust column widths interactively using cursor-control keys that instantly show the effect of your changes. The menus for sorting and math both offer a rich set of options but seem needlessly complex compared with more recently upgraded areas.

The macro language has evolved to the point where you can make *WordPerfect* the hub of a fully automated document processing system, complete with customized menus. That system can incorporate other DOS applications and the electronic mail services of the network version of *WordPerfect Office*. Using simple menus, you customize the keyboard to attach macros to keys, but a keystroke can restore the default keyboard.

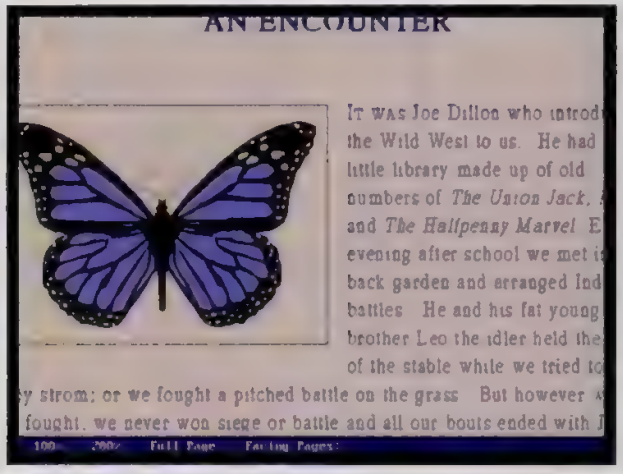
Almost everything about *WordPerfect* is smooth and sleek, as a result of the programmers' exceptional responsiveness to users' suggestions and requests. Installation is foolproof enough for beginners and rich in options for advanced users, and it won't waste your time with functions you don't need. With most advanced

packages, you have to specify your hardware and reinstall if you change video cards or monitors; *WordPerfect* almost always detects every detail of your hardware and adjusts automatically. It's equally forgiving of your mistakes: a three-level undelete understands that when you have deleted six words in a row you may want all of them back as a single level of deletions.

ISLANDS OF DISORDER

With all its strength and coherence, *WordPerfect* still has some surprising weaknesses and islands of disorder. The new menus don't entirely compensate for a function-key interface that drives many users to distraction. You still can't enter a format code to specify that all paragraphs following the code (or in a defined block) will have the same first-line indent, and indents are still tied awkwardly to tab settings. You are now able to specify extra spacing below every paragraph, but you don't have the same control of space above paragraphs or the option of keeping two paragraphs automatically on the same page. Styles let you accomplish some of these functions if you use them when you are first creating text. It's exceptionally difficult to apply DTP-type formatting to text that you've previously created without styles or that you have imported from somewhere else.

You still have to enter a page number code in the unintuitive form Ctrl-B, although a menu can do the job for you. You can search for the code that indicates a margin change, but for some absurd reason, you can't search specifically for the particular code that changes the margin to 1.5 inches. Similarly, you can search for a code that changes fonts, but not for the specific font (like Palatino 11, for example) that the code calls for. Unless you take the time to switch fonts, you can't tell *WordPerfect* to break long lines at the edge of the screen so you can read your text without scrolling beyond the right edge.



***WordPerfect*'s print preview uses generic fonts to represent serifed and non-serifed typefaces, but its fine detail provides a close representation of the printed page.**

With most packages, you have to specify your hardware and reinstall if you change video cards or monitors;* WordPerfect *almost always adjusts automatically.

WordPerfect's speller is well integrated into the rest of the program and, uniquely, lets you customize its main dictionary, which now contains hyphenation data. But it still doesn't have the ability to flag punctuation or capitalization errors that are caught by rival programs. You can check a word, page, block, or complete file, but you have to define a block if you want to check spelling from the cursor position to the end of the file. Cursor movement is often more annoying than it needs to be: Two presses of the Home key followed by the Up arrow get you to the top of the text in your file, but you have to press Home three times to get to the top of the codes.

AN UNQUESTIONED STANDARD

WordPerfect 5.1 can trade files with versions for the Macintosh, Unix, DEC, and almost all other significant platforms, with versions for *Windows* and Presentation Manager due in 1991. *LetterPerfect*, a $229 stripped-down PC version for laptops or occasional users, is compatible with 5.1 files, although it can't access all 5.1 functions.

Compared with *WordPerfect*, *Microsoft Word* provides easier formatting, and *Nota Bene* makes it easier to enter and edit text, but *WordPerfect* remains the unquestioned corporate and personal standard for character-based word processing on a PC. You'll need a strong incentive to choose anything else.

WordStar

Programs, like their users, can't stay young forever. *WordStar*, now in Version 6.0, is unable to perform many of the acrobatic feats that leave its younger rivals unfazed, but there's still life in the old classic. For $495, WordStar International gives you a program that can be made to look almost exactly like the word processor that made the transition from CP/M machines to the PC, and that many computer veterans regard as the only real word processor ever invented. If you're looking for something more up-to-date, *WordStar* 6.0 also gives you modern conveniences that you can't find anywhere else, like a print preview that matches LaserJet soft fonts and lets you display multiple pages on-screen or zoom in for a close-up view.

WordStar has the tendency to get sleeker as it gets older. It now lets you open two windows on different files and lets you define a block in each window simultaneously. It supports snaking columns. You can create a rudimentary form of paragraph styles and switch from one style to the previous one without specifically naming it. A window displays high-order ASCII characters and lets you enter the one you need. You have the choice of using standard *dBASE* and *Lotus 1-2-3* files (but not *1-2-3*, Release 3, files) for merges, or importing them directly into *WordStar* documents. If your spreadsheet has named ranges, *WordStar* will prompt you to choose the range you want to include from a menu.

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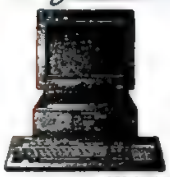

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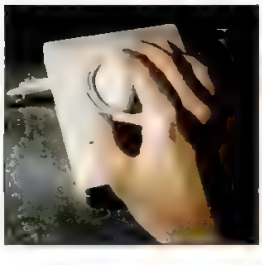

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LOYALTY TO INTERFACE

In its attempt to keep up with the upstarts who took over its market in the mid-eighties, however, the program has become an often uncomfortable combination of the old and the new. Because *WordStar* dates back to the era before function keys, you can still accomplish almost anything without taking your fingers off the main keyboard—although some of the program's many Ctrl–alpha key commands are duplicated by function keys. (Line drawing is one feature that requires function keys, but it's so awkward that you won't use it.)

This interface can have considerable appeal for touch typists, but you may find that the time you lose to performing *WordStar*'s often overly elaborate command sequences is greater than the time you save by keeping your fingers away from the arrow or function keys. But *WordStar* is one of the few programs that gets something done when your hands are entirely off the keyboard: You can choose commands that will make the program scroll through your file line by line or screen by screen as you watch.

FOOLPROOF HELP SYSTEM

WordStar pioneered a help system that's still the most useful in the business. As long as you keep the help system to the level favored by everyone except experts, it notices if you hesitate after typing the first letter of a two-letter Ctrl-key combination and displays the menu with the available choices of the second level.

If, for example, you remember that Ctrl-Q is the first letter of *WordStar*'s "Quick" commands for cursor movement, spell-check, math, and other miscellaneous functions, but you don't remember that Ctrl-Q-Equals is the command that jumps to the next font code, or that Ctrl-Q-I takes you to a specified page, or that Ctrl-Q-J opens the thesaurus, the Quick menu will appear when you fail to type the second letter. Once your fingers can perform these and dozens of other arbitrary Ctrl-key combinations, you can turn off the menus entirely.

WordStar *is one of the few programs that gets something done when your hands are off the keyboard: It can scroll through your file line by line or screen by screen as you watch.*

***WordStar*'s editing screen often looks like a meeting of the old and the new: dot commands from the early days of *WordStar*, plus optional SAA-compatible pull-down menus. The pull-down menus, which you access with Alt keys, indicate the old-style Ctrl keys that you can use as an alternative.**

New users can add a completely different set of SAA-compatible pull-down menus accessed with Alt-key combinations. These menus contain most of the commands in the classic Ctrl-key menus, although the commands are grouped under different headings. The pull-down menus don't support first-letter shortcuts, so you have to move the cursor down to the option you want. They display the Ctrl-key combinations that will perform the same command, and you can use the Ctrl-key while the Alt-key menu is on display. If this sounds confusing, it is, and the sooner you decide to learn the Ctrl keys the easier life will be.

DOT COMMANDS LIVE

WordStar still uses its classic dot commands like ".rm 65" to set most page formatting, and control codes like "^S" (which means underline) or font codes like "<TIMES 11.0>" to set most text formatting. Whenever the program finds a period at the start of a line it treats the rest of the line as a dot command and won't print it.

Your files quickly grow littered with distracting dot commands, and if a line happens to start with an ellipsis or a decimal number like .5, *WordStar* won't print the line unless you insert a pair of dummy control codes before the period. Because you'll probably tell the program not to display control codes on screen, to avoid seeing a "^S" pair around every underline, it's easy to misplace a dot command after a control code. The result is that the dot command prints out in your file instead of controlling format. If you use a dot command to create an index entry—and you can choose other methods—you have to place it before the paragraph with the item indexed. If most of the paragraph prints on the following page, the index entry will point to the wrong page.

With most word processors, if you change the margins in the middle of the file, the program assumes that you meant what you indicated and changes the margins for you. *WordStar* merely inserts the margin-change code but doesn't do anything about it (except in the current paragraph) until you press Ctrl-Q-U to update the formatting of the file or edit each of the remaining paragraphs. Some *WordStar* users insist they like it that way, presumably because *WordStar* takes far more time to reformat than most rival programs do, and it can be extremely tedious to change margins at ten different points in a file and wait while *WordStar* reformats each time. The obvious solution, of course, would be for *WordStar*'s programmers to rewrite the program so that it reformats quickly.

CONTROL-KEY COMPLEXITY

WordStar's control keys can cause even more problems than dot commands. Because the program can't record keystroke macros, you have to enter control keys and ordinary typing in a macro creation menu. You can't enter a control key directly, but must precede it with Ctrl-P. To add to this complexity, you can only put

SUITABILITY TO TASK

the Enter key in a macro as Ctrl-M, preceded by Ctrl-P.

If you want to create a header with flush-left and flush-right text on the same line, you first type the flush-left text, then press Ctrl-P-Enter to tell the program to overprint the preceding text with the text that follows. You then type the flush-right text, followed by Ctrl-O-]. Other programs achieve the same feat with one simple code.

WordStar is capable of displaying on-screen most of the format commands that begin with Ctrl-P—including such obscure pairs as Ctrl-P-V for subscripts and Ctrl-P-Y for italics. But the Ctrl-P-Enter command for overprinting is indicated only by a minus sign in the column on the far right of the screen that has symbols for distinguishing lines with dot commands from lines with text. It's all too easy to find overprinted text in a printout, and by a similar token it's all too difficult to locate it on-screen.

FACT FILE

***WordStar*, Version 6.0**
WordStar International Inc., 201 Alameda del Prado, Novato, CA 94949; (800) 227-5609.
List Price: $495.
Requires: 384K RAM (512K for preview and outliner), DOS 2.0 or later.
In Short: *WordStar* 6.0 (really a minor upgrade to 5.5) is an uneasy combination of high-tech and low-tech functions. Its print preview, which provides thumbnail or expanded view, goes as high as high-tech can go, but its combination of awkward dot commands and slow, manual reformatting holds the program on a much lower level. Loyal *WordStar* users get enough modern conveniences to make an upgrade to 5.5 or 6.0 almost obligatory. Mail-merge remains highly flexible.

WORDSTAR

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To search for an underline code, you enter Ctrl-P before the Ctrl-S of the code itself in the Find menu. But if you want to search for the Ctrl-P-Enter overprinting code or a font change code within footnotes, you're out of luck because there's no way to do it. You have to search for each footnote individually—a search that doesn't use the Find menu but a completely different control code. Then you search for each font change separately, another search that uses another command that's not on the search menu.

WordStar won't let you print the file on-screen without saving it to disk first, although it returns keyboard control to you as soon as you give the print command. It performs searches at one-third the speed of more-advanced programs, and has a sluggish feel when entering text in justified format. *WordStar*'s mail-merge has always been one of its strengths, although its extensive use of dot commands now seems archaic. You can use a supplied MailList program to create a date file for a merge, or use standard spreadsheet or database files. Oddly, you can't use ordinary *WordStar* files, although you can use *WordStar* to create what it calls "nondocument" files in ASCII format.

WordStar's print preview is unique in showing multiple pages with close representations of the original type. You can jump almost instantly from the tiny thumbnail pages shown here to detailed enlargements, complete with grid lines.

A COLLECTION OF ADD-ONS

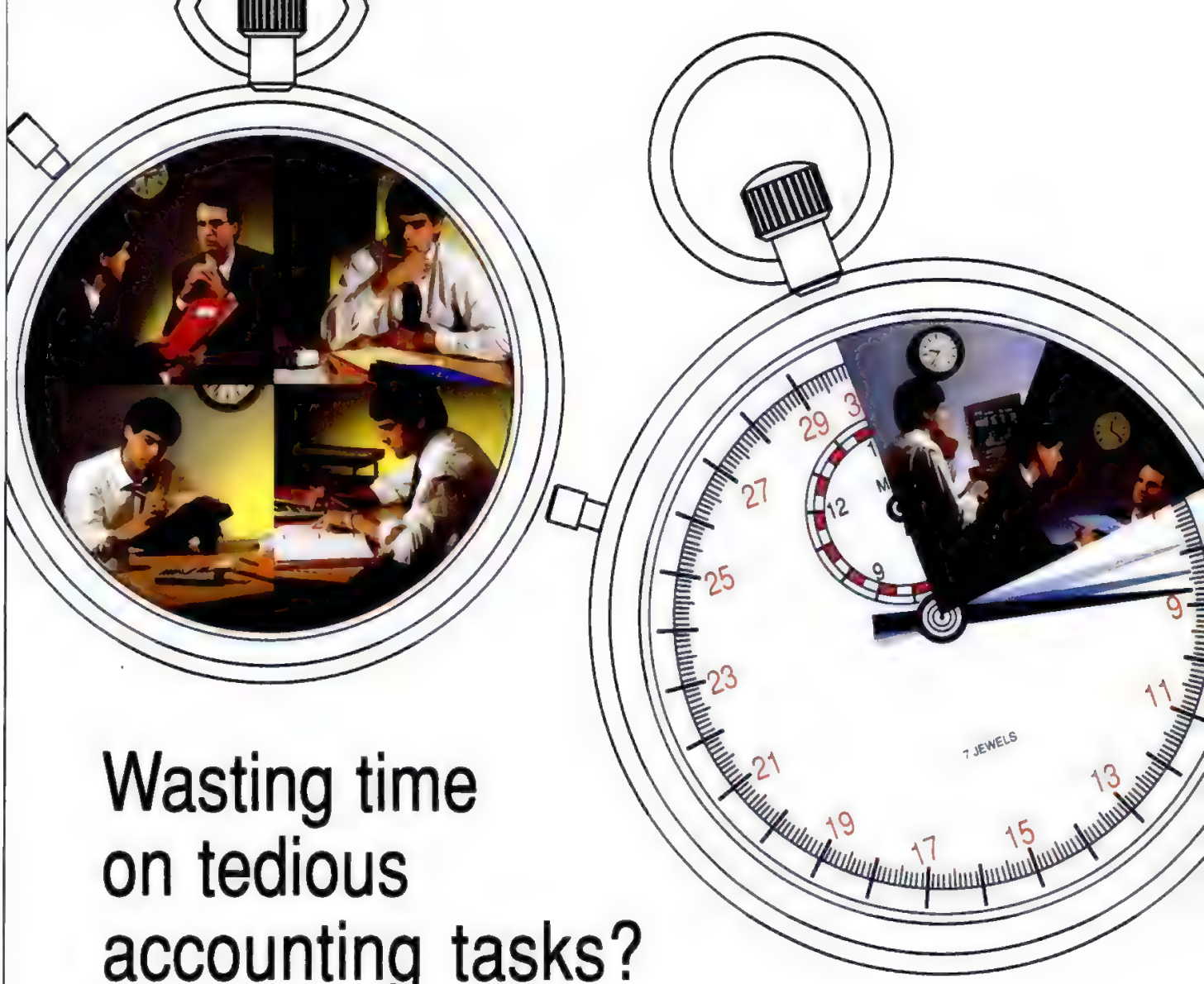
The *WordStar* package includes "companion programs" loosely linked to *WordStar* itself. *ProFinder* is a bare-bones file manager in which you can select a file, hit a hotkey, and edit the file in *WordStar*. The manual suggests that you change the hotkey because it conflicts with the zoom key in *WordStar*'s print preview—a typical example of the incomplete integration of *WordStar* and its companions. You also get a communications package best suited to on-line services, which you can run from *WordStar*'s main menu.

Yet another add-on is *Inset*, a capable graphics capture and editing package that you load as a TSR and call up from within *WordStar* for modifying bitmap images. You can add graphics to *WordStar* files using a code that references the graphics file, but *WordStar* won't automatically make room for the picture. Oddly, you can't import other graphics formats; can only capture screens. Another add-in, *PC-Outline*, is a capable pop-up outliner, but doesn't automatically create *WordStar* files. Finally, the package includes a version of one of the best file-conversion programs, *Software Bridge*, which is customized for converting to and from *WordStar* format.

The complete *WordStar* package is a loose-limbed collection of miscellaneous software, but the classic core of the package, *WordStar* itself, retains the loyalty of thousands of users. Despite the new version number, *WordStar* 6.0 is only a modest upgrade from 5.5, notable mostly for adding LaserJet III support and enhancements to paragraph styles that were already included in a late revision of 5.5.

Still, *WordStar* veterans will welcome it with open arms, and the program's loyalty to its own Ctrl-key interface might still attract new users who dislike the function keys of more modern programs. But *WordStar*'s faded star will need a lot of polishing before it regains the shine with which it glowed in the software firmament a decade ago. ■

Edward Mendelson is a contributing editor of PC Magazine.



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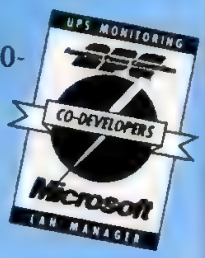

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NETWORKING IN THE 90s

by M. Keith Thompson

Novell's NetWare 3.1 faces a formidable challenge in Microsoft's LAN Manager 2.0. Totally revamped, LAN Manager 2.0 offers a lower entry price and easier upgradability, but is that enough to dethrone the original network king?

Today, most network servers function as shared peripheral managers. They let client PCs on the network share printers and hard disk drives. This situation has been static for the past few years, but it's about to change. Over the preceding years of the LAN evolution, programmers have lacked the tools—and network operating systems have lacked the power—to create and run true network-aware applications: programs that can take advantage of user naming, data management, and data security features available from the LAN operating system. Even fewer programs distribute the computing load between the computer acting as a file server and the client workstations. The programs that people use most frequently on networks are still standalone applications storing files on a shared drive.

LAN Manager 2.0 and *NetWare 386*, Version 3.1, are two network operating systems that will change the architecture of local area networks. They include the tools and the interfaces needed to create efficient applications with tight integration of the information and server power available on the network. The only limitation for an application under these products is the programmer's imagination.

SPROUTING FROM NETWARE

The release of early versions of Novell's *NetWare* in 1982 planted the seeds for network evolution. *NetWare* provided a powerful file server environment and even a few development tools, such as a menu utility. Some companies, like Data Access Corp. and MDBS, released database development tools for the early *NetWare* file- and record-locking scheme. But neither *NetWare*'s file-management schemes nor the development tools of outside companies were standard, and the companies behind these products lacked the resources to give them a big marketing push. Microsoft's introduction of DOS file- and record-locking schemes in 1984 made the techniques used by Novell obsolete.

The 1989 release of *NetWare 386* 3.0 continued to break new ground, exploiting the memory and storage capacity of 80386- and 80486-based servers. Version 3.1 extends the evolution by increasing efficiency and supplying the tools needed to create powerful server-based and network-aware applications.

THE LAN MAN COMETH

Microsoft's *LAN Manager* evolved from the DOS-based MS-Net operating system. The original *LAN Manager* program took advantage of OS/2's powerful multitasking abilities but lacked many of the features necessary to take any significant market share from *NetWare*. Despite backing from giants like IBM and savvy companies like 3Com, who marketed *LAN Manager* under their own labels, the product's first release caused hardly a ripple in the building torrent of network buying. We predict a much bigger splash for the new release of *LAN Manager*, Version 2.0—backed and marketed directly by Microsoft with more support provided by IBM, 3Com, AT&T, and other companies. *LAN Manager* 2.0 competes head-to-head with the king of network computing in terms of speed, security, dependability, and the power of its development tools.

It bears repeating that while *LAN Manager* is an application designed to run under OS/2, it can serve networks of PCs running either MS-DOS or OS/2.

However, Microsoft's marketed version of *LAN Manager* inherits the operating system's strengths and weaknesses. To *LAN Manager*'s advantage, OS/2 is a highly promoted multitasking operating system. The present rush to *Microsoft Windows* 3.0 is preparing an infrastructure of computers, users, and developers for the introduction of OS/2. Administrators know they have to buy computers with more memory and more-powerful CPUs; users come to accept the graphical user interfaces (GUIs); and developers learn how easy it is to write programs for both *Windows* and OS/2. Programs designed to work under OS/2 require little modification to become LAN-aware applications. However, OS/2's 16-bit addressing and 16MB memory limitation restrict the size and power of *LAN Manager* programs.

> There is a difference in philosophy between *LAN Manager* and *NetWare* that can affect the way you design the entire network.

The biggest improvement in *LAN Manager* 2.0 over the previous version is the increased throughput gained from the new High Performance File System (HPFS), first implemented in OS/2 1.2 and later updated as HPFS386 for 386- and 486-based computers. HPFS caches directories, data, and file system structures to improve throughput.

TO SHARE OR NOT TO SHARE

There is a fundamental difference in philosophy between *LAN Manager* and *NetWare* that can affect the way you design the entire network. *NetWare 386* runs on hardware dedicated to the task of acting as a server. Server-based applications can run in the server PC, but that server can never act as a local workstation.

Because *LAN Manager* is an application running over OS/2, the server can run spreadsheet, word processing, and other programs while moving data to and from other computers on the network. This means that every network client running OS/2 can act as a *LAN Manager* print, file, or communications server and as a workstation at the same time.

During a trip to the Microsoft campus outside Seattle, our LAN Labs crew came to understand the power, potential, and problems of this architecture. For example, when you type a command to list the available servers on Microsoft's own network, you see hundreds of server names. Each server name is also someone's desktop PC. Each machine makes some resources available, and groups working on specific projects can use the resources in whatever way makes sense.

So, while you might dedicate a PC to the task of acting as a server on a busy *NetWare* or *LAN Manager* network today, as the number of PCs running OS/2 grows, so will the number of potential *LAN Manager* servers. The distributed and nondedicated server architecture available under *LAN Manager* and OS/2 play an important part in the growth of this product.

THE REAL NEWS

The real news about *LAN Manager* 2.0 and *NetWare 386* 3.1 is that both are mature platforms for commercial and in-house developers of applications. Both are fast enough, have enough capacity, and have the tools to support applications that are able to reside partially in the server, communicate between client PCs, and use information they obtain from the operating system.

While both *LAN Manager* 2.0 and *NetWare 386* install more easily than older and less-capable operating systems, understanding and designing a network requires many hours of planning and learning. You have to catalog and evaluate the resources you want to share, the activities of each user, how and what people will print, and how you will ensure security.

THE NICER PRICE

Networks can cost a lot of money to install and run. Typically, the cost of cables, adapters, and hardware for servers greatly outweighs the cost of the network operating system. However, you need to look at the cost of all of these products, because it can run fairly high.

You'll probably get sticker shock from the $7,995 price of *NetWare 386*. This includes everything except a copy of MS-DOS for the server, and the price stays the same whether you run a small network or whether you have hundreds of people using the same server. Of course, Novell offers Entry Level System and *Advanced NetWare 286* packages at attractive prices for organizations that need less server power.

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Dac Easy Accntng 4.1 .....78.
Dac Easy Bns Pak 4.1 .....158.
Dac Easy Payroll 4.1 .....58.
Great American Software
Money Matters 1.0 .....50.
Onewrite Master Module 2.06 .....88.
Onewrite Plus Accntng. System 2.06 ...164.
One-write Plus Payroll 2.06 .....88.
Intuit
Quicken 4.0 (New!) .....34.
Meca
Check Write Plus 1.1 .....28.
Managing Your Money 6.0 .....115.
Monogram
Dollars And Sense 3.1 .....94.
Peachtree Software
Peachtree Cmplete III .....138.
Peachtree Complete III Double Bonus Bundle ....218.
Symantec
Budget Express 1.1 .....98.

BUSINESS & PRESENTATION

Adobe
Postscript Cartridge .....259.
Type Cartridge 1 or 2 .....228.
Type Set 1 or 2 .....65.
Type Set 3 .....129.
Alpha Software
Alpha Four 1.1 .....298.
ASD Software
Planisoft .....148.
Ashton Tate
dBase IV .....478.
Framework III 1.1 .....448.
Asksam Systems
Asksam 4.2 .....160.
Avery
LabelPro (Laser) .....48.
Bitstream
Collections .....128.
Face Lift .....57.
Headlines 1-6 .....88.
Bloc Publishing
Corporate Ladder 1.1 .....44.
Blythe Software
[illegible]
Borland International
Paradox 3.0 .....444.
Quattro Pro .....294.
Broderbund
Memorymate 3.02 .....37.
Buttonware
PC-File 5.0 .....71.
CE Software
QuickMail 2.2 .....55.
Chronologic Corp.
Instant Recall .....63.
Chronos Software
Who-What-When 2.0 .....171.
Contact Software Int'l
Act! .....218.
DataEase International
DataEase 4.2 .....475.
Digital Composition
DB Publisher Pro 2.1 .....428.
DB Publisher Report Maker 2.0 .....184.
Dow Jones & Company
Dow Jones News Retrieval Kit .....18.
Market Analyzer 2.0 .....209.
Enable Software
Enable/OA .....408.
Enable/BP .....109.
Fox Software
Foxbase+ Development System 2.1 .....184.
Foxgraph 1.0 .....184.
FoxPro .....468.
IBM
Current [illegible]
Individual Software
Resume Maker 1.1 .....28.
Informix
Wingz [illegible]
Lotus
Agenda 1.01 .....258.
GraphWriter II 2.0 .....348.
Lotus 1-2-3 Rel. 3 .....408.
Symphony 2.2 .....528.
Microrim
Clout 3.02 .....198.
R:Base Compiler .....578.
R:Base for Dos 2.1 .....455.
Microsoft
Book Shelf CD Rom .....188.
Excel for Windows 2.1 .....298.
Project for Windows 1.0 .....454.
Works 2.0 .....88.
Nantucket Corp.
Clipper 5.0 .....492.
New England Software
Graph-In-The-Box Executive .....158.
Nolo Press
For The Record 1.0 .....28.
Patton&Patton Software
Flow Charting III .....128.
Power Up Software
Calendar Creator Plus .....38.
Top Priority .....57.
Precision Software
Superbase 4 for Windows 398
Primetime Software
Primetime Personal .....67.
Reality Technologies
WealthBuilder 1.1 With Quicken .....134.
Software Publishing
Harvard Project Manager 3.01 .....432.
PFS: First Choice 3.02 With Prodigy .....104.
Professional File .....188.
Symantec
Time Line 4.0 .....458.
Q & A 3.0 .....218.
Timeslips Corp.
Timeslips III 3.4 .....164.
Wordperfect Corp.
PlanPerfect 5.0 .....257.

WORD PROCESSING

Ashton Tate
Multimate 4.0 .....290.
Caere
[illegible]
Lotus
Manuscript 2.1 .....322.
Microsoft
Word 5.0 .....204.
Windows Word 1.0 [illegible]
OCR Systems
[illegible]
Olduvai
Read-It! OCR Personal ....145.
Reference Software
[illegible]
Rightsoft
Rightwriter 4.0 .....48.
Samna
Ami Professional [illegible]
Software Publishing
Officewriter 6.1 .....234.
Professional Write 2.1 .....138.
Spinnaker
The Resume Kit .....28.
Symantec
Q&A Write 1.01 .....131.
Wordperfect Corp.
Wordperfect 5.1 .....244.
Wordstar U.S.A.
Wordstar 6.0 .....255.
XY-Quest
XY Write III Plus 3.55 W/Menus .....214.

GRAPHICS & DESIGN

Adobe
Illustrator for Windows 1.0 278
Streamline 213
Aldus
PageMaker [illegible]
Application Techniques
Pizzazz Plus .....66.
Autodesk
Autodesk Anim. 1.0 [illegible]
Bloc Publishing
Form Filler 2.0 .....83.
Form Tool Gold 3.0 .....55.
Broderbund
Bannermania .....20.
New Print Shop .....34.
Corel Systems
CorelDraw! 1.2 318
Custom Applications
Freedom of Press [illegible]
Delrina Technologies
Per:Form Designer & Filler 2.1 .....158.
Per:Form Pro for Windows [illegible]
Electronic Arts
Deluxe Paint II .....88.
Formgen Corp.
Formgen Plus 5.0 .....139.
Formworx Corp.
Formworx w/Fill & File 2.5 .....79.
Form Pub [illegible]
Lotus
Freelance Plus 3.01 .....338.
Matrix Software
Layout 2.0 .....128.
Micrografx
[illegible]
Microsoft
[illegible]
PC Publishing
Impress .....73.
Personics
Ultravision 2.0 .....78.
Power Up Software
Express Publisher .....82.
Software Publishing
Harvard Grphcs 2.3 .....308.
PFS: First Publ. 3.0 .....94.
Timeworks
Publish It! 1.1 .....105.
Publish It! Lite .....32.
T/Maker
ClickArt Business Cartoons 41
EPS Business Art 79
EPS Illustrations 84
Holiday Images 44
Personal Graphics 44
Publications 44
Unison World
Avagio .....168.
Wordperfect Corp.
DrawPerfect 1.1 .....268.
Xerox
Gray F/X .....295.
Ventura Publisher Gold 3.0 .....518.

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Design Cad 3D 3.0 ..... 398.
AutoDesk
AutoSketch 2.0 ..... 94.
ComputerEasy Software
Dream House Professional ..... 46.
Floor Plan ..... 25.
Foresight Resources
Drafix Cad for Windows 434
Drafix Cad Ultra ..... 242.
Generic Software
Basic Home Design Symbols ..... 30.
Generic Cad 3D Drafting ..... 178.
Generic Cad Level 3 ..... 208.
Mathsoft
MathCad 2.5 ..... 292.

ENTERTAINMENT

Accolade
HardBall II ..... 32.
Jack Nicklaus' Golf ..... 27.
Activision
The Music Studio 3.0 ..... 58.
Bethesda Software
Hockey League Sim. ..... 28.
Wayne Gretzky Hockey II ..... 38.
Broderbund
Simcity 1.1 ..... 28.
The Playroom ..... 26.
Where in Time is Carmen San Diego? ..... 29.
Where in the World is Carmen San Diego? ..... 29.
Where in the USA is Carmen San Diego? ..... 29.
Where in Europe is Carmen San Diego? ..... 29.
Electronic Arts
Hunt for Red October ..... 19.
John Madden Football ..... 30.
Bard's Tale II ..... 18.
Chessmaster 2100 ..... 33.
Chuck Yeager's AFT II ..... 38.
Crib. King/Gin King ..... 28.
Earl Weaver Baseball ..... 30.
Grand Slam Bridge ..... 44.
Populous ..... 38.
Starflight 2 ..... 38.
Indiana Jones and the Last Crusade ..... 32.
Microprose
F-15 Strike Eagle II ..... 38.
F-19 Stealth Fighter ..... 37.
Red Storm Rising ..... 31.
Microsoft
Flight Simulator 4.0 ..... 37.
Sierra On-Line
King's Quest III ..... 32.
King's Quest IV ..... 32.
Leisure Suit Larry II ..... 38.
Leisure Suit Larry III ..... 38.
Police Quest II ..... 32.
Silpheed ..... 20.
Space Quest II ..... 32.
Space Quest III ..... 36.
The Colonel's Bequest ..... 38.
Thexder ..... 23.
Spectrum Holobyte
Falcon-AT ..... 31.
Tetris ..... 21.
Vette! ..... 25.
Welltris ..... 21.
Spinnaker
Sargon IV ..... 31.
Toyogo
Go Master ..... 44.
Joseki Genius ..... 28.
Tactical Wizards ..... 33.
Virgin Mastertronic
Clue ..... 22.
Monopoly ..... 22.
Scrabble ..... 22.

EDUCATION

Bloc Publishing
Personal Lawyer ..... 34.
Lifestyles Edition ..... 38.
Harvard Associates
PC Logo 3.0 ..... 58.
Individual Software
Professor Dos 4 ..... 26.
Learning Company
Math Rabbit ..... 25.
Reader Rabbit ..... 25.
Writer Rabbit ..... 25.
Meca
Home Lawyer 1.0 ..... 68.
Nolo Press
Willmaker 4.0 ..... 33.
PC Globe Inc.
PC Globe 3.0 ..... 35.
PC Nations ..... 18.
PC USA ..... 35.
Penton Overseas
French, German, Italian, Japanese, Hebrew, Russian, and Spanish; Levels I,II ..... 38.
True Basic, Inc.
Algebra 4.0 + Wrkbook ..... 48.
Arithmetic ..... 44.
Calculus 4.0 + Wrkbook ..... 48.
Pre-Calc 4.0 + Wrkbook ..... 48.

PROGRAMMING

Asymetrix
Toolbook for Windows 3.0 294
Borland International
Turbo C++ Prof. 1.0 ..... 158.
Turbo Pascal Prof. 5.5 ..... 168.
Digitalk
Smalltalk/V 286 1.1 ..... 118.
Smalltalk/V 2.0 ..... 58.
Microsoft
Basic Professional Dev. Sys. 7.0 ..... 328.
C Compiler 6.0 ..... 309.
Macro Assembler ..... 98.
Quick Basic 4.5 ..... 64.
Quick C 2.0 ..... 62.
Quick Pascal 1.0 ..... 62.
Windows 3.0 Software Dev. Tool Kit 318
Peter Norton Computing
Guides for Assembly, Basic, Pascal, and C ..... 59.
True Basic
True Basic 2.1 ..... 51.

UTILITIES

Above Software
Above Disk 3.1 ..... 58.
Adobe
Type Manager for Windows 3.0 58
ATM Windows Plus Package 129
Bloc Publishing
Disk Vision 1.1 ..... 44.
Pop Drop Plus ..... 55.
Print Rite 1.3 ..... 59.
Print Vision 2.0 ..... 45.
Borland International
Sidekick Plus ..... 144.
Broderbund
[illegible]
Diagnet for Windows 88
Central Point Software
Copy II PC 5.0 ..... 21.
PC Tools Deluxe 6.0 ..... 84.
Dariana
Ain Sleuth ..... call
System Sleuth ..... call.
Delta Technologies
Direct Access ..... 55.
Direct Net ..... 145.
Fifth Generation
Brooklyn Bridge 3.0 ..... 85.
Mace Utilities 1990 ..... 84.
Mace Vaccine 5.0 ..... 58.
Fastback Plus 2.09 ..... 109.
Funk Software
PDQueue ..... 53.
Sideways 3.21 ..... 36.
Gibson Software
Spinrite II ..... 68.
hDC Computer
First Apps 48
Windows Express 48
Helix
Headroom 2.1 ..... 71.
aser Go
Go Script Plus 3.0 ..... 188.
Lotus
Magellan 2.0 ..... 108.
Merril & Bryan
Turbo EMS ..... 48.
Microsoft
Windows 3.0 87
Multisoft
PC Kwik Power Disk ..... 45.
PC Kwik Power Pak ..... 69.
Super PC Kwik 3.3 ..... 48.
On Track Computer
Disk Manager 4.0 ..... 48.
Peter Norton Computing
Norton Utils Adv. 5.0 ..... 119.
Norton Comnder 3.0 ..... 89.
Norton Backup 1.1 ..... 94.
Power Up Software
Name That Disk ..... 31.
Prime Solutions
Disk Technician Advanced 6.0 ..... 87.
QMS
Ultrascript PC 2.1 128
Qualitas
386 Max Professional ..... 74.
Quarterdeck Office Systems
Desqview 2.3 ..... 68.
QEMM 5.1 ..... 54.
QRAM 1.0 ..... 44.
Revolution Software
Cruise Control 3.02 ..... 31.
VGA Dimmer ..... 31.
Softlogic Solutions
Double Dos 5.0 ..... 44.
Magic Mirror ..... 58.
Software Carousel ..... 54.
Disk Optimizer 4.05 ..... 44.
Touchstone
Check-it! ..... 81.
Vericomp
Softbytes 2.0 ..... 34.
Xtree Company
Xtree Pro Gold ..... 75.

COMMUNICATIONS

Compuserve
Dos Membership Kit ..... 21.
Crosstalk Communications
Crosstalk Mark IV ..... 127.
Crosstalk for Windows ..... 117.
Remote II Host 2.0 ..... 79.
Datastorm Technologies
Hot Wire ..... 68.
Procomm Plus 1.1 ..... 59.
Dynamic MicroProc. Assoc.
PcAnywhere IV ..... 99.
Hayes
Smartcom II 3.0 ..... 89.
Hilgrave
Hyperaccess/5 1.1 ..... 119.
Microcom
Carbon Copy Plus 5.2 ..... 109.
Carbon Copy Autopilot ..... 53.
Relay Gold 4.0 ..... 161.
Travelling Software
DeskLink 2.21 ..... 99.
LapLink III ..... 85.

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Microsoft, on the other hand, lets you build in increments. A five-user version of *LAN Manager* costs $995. Adding another ten users costs another $995. If you want to jump into an unlimited user version for one server, you'll pay $5,495 for the package.

Microsoft has underbid Novell in the 386 operating system market. The significant difference in price and the smooth upgrade path—you can grow from five to hundreds of users while retaining economy and the same software—might tip the scales in Microsoft's favor for many buyers.

MORE THAN SPEED

Both file systems are so fast that speed is no longer a big factor in determining which operating system to buy. The two most important questions to ask are "Which LAN operating system will solve my problems?" and "Who will give me the best support?" Still, since each system handles data differently, the speed issue is worth an in-depth look. *NetWare* handles standard applications efficiently, but *LAN Manager* focuses its strengths on enterprise-wide networks.

Most PC applications request data in small blocks. This approach is a carryover

THE EMERGING IMPORTANCE OF BANYAN'S VINES

by M. Keith Thompson

VINES is a full-function network operating system that runs under Unix, accommodating an unlimited number of users for the list price of $5,995. Unix provides an ideal environment for a network operating system, a fact recognized by AT&T with its *StarGroup*, Version 3.3 (see "LAN Operating Systems: The Power Behind the Server," *PC Magazine*, May 29, 1990). AT&T licensed the *LAN Manager* OS/2 source code from Microsoft and ported it to Unix.

Since Unix is both multiuser and multitasking, it can handle many users and run multiple server-based applications simultaneously. Other advantages of Unix include excellent WAN, server-to-server, and dial-up communications. Unfortunately, however, *VINES* cannot take advantage of these services unless the product is *VINES*-specific (such products are available from Banyan as well as from third parties).

NOT WELL KNOWN

Banyan's lack of significant market share means that many companies do not understand much about its network product. In fact, Banyan pioneered global naming services with StreetTalk, a useful feature that is now being implemented by all other network operating systems. A global naming service assigns resources located on different servers certain access rights for each class of user; StreetTalk maintains and updates these rights on all the servers in the network. The scheme allows a user to log on to one server with one password and then access resources on other servers in the network.

Banyan is committed to supporting industry standards. In cooperation with Microsoft, *VINES* supports SMB, NDIS, NetBIOS, Named Pipes, mailslots, and *LAN Manager* APIs. This gives vendors similar development environments and leads to a larger potential market for their product. Ideally, a *VINES* workstation could act as a client for a *LAN Manager* server-based application.

VINES is one of two network operating systems (the other being *LAN Manager*) to support multiple-processor servers. *VINES* derives this support via a specially designed version of Unix V for the Compaq Systempro, currently the only computer certified by Banyan for multiprocessor support. Unlike LAN Manager under OS/2, *VINES* divides the tasks evenly between the processors by assigning the next task to the first available processor.

Many corporations don't know as much about Banyan's *VINES* as they do about some of its competitors, but this Unix-based network operating system has features that will become increasingly important in country-wide corporate networks.

VINES is particularly well suited to geographically diverse companies. With Unix-to-Unix CoPy, servers around the country can intelligently update each other in an efficient manner. Banyan's host of communications products aimed at mini and mainframe computers includes products for server-to-server communication within the LAN, over a WAN, or through an X.25 network, as well as e-mail, remote network management, and advanced 3270/SNA terminal emulation products.

One advantage Banyan has over the competition is its experience in client/server computing. In many companies today, *VINES* runs SQL-based database operations—more significantly, it has been doing so for years. These custom applications, ranging from accounting to inventory management to sales tracking, have established a track record for smooth operation. *VINES* is also outstanding in security: It benefits both from its own features and from the intensive ones built into Unix.

VINES provides an all-in-one-box solution for hooking to remote servers, transferring data to other servers, and connecting to SNA gateways, async services, database servers, and mail servers. Of course, the fact that you *must* put all your eggs in one basket—unless you're willing to go to the expense of having multiple servers—means you risk losing all your network services with one hardware problem.

Overall, Banyan's *VINES* is a strong contender in the mainstream network operating system market, boasting excellent communications for multilocation networks and the ability to work on a variety of hardware platforms. The only thing it lacks is speed: it cannot compare to *NetWare 386* and *LAN Manager*. Since country-wide corporate networks are playing an increasingly important role in day-to-day computing, more managers will need to take a close look at *VINES*. ■

from the days when most PCs did not have much RAM and all data was stored locally. Many databases still request data from the file server in blocks of less than 100 bytes, and even modern applications such as electronic mail often move messages in blocks of 60 to 80 bytes at a time. To get the greatest throughput, therefore, Novell's engineers designed IPX, the transport layer of all *NetWare* versions, to handle data the way most applications request it: in small blocks.

Other high-end DOS-based environments, such as LANtastic, also use IPX for data transfer. On the other hand, *NetWare* can be less efficient than *LAN Manager* or Banyan's *VINES* for LAN-to-LAN communications (see the sidebar, "The Emerging Importance of Banyan's *VINES*"). Since IPX does its own error checking, it generates redundant traffic on networks already using a higher level of error checking like X.25—one of the primary means of linking LANs.

The method of programming applications to be handled in small blocks is slowly changing. Smart developers write networked applications to take advantage of larger buffers and file caches available in modern LANs. *LAN Manager* performs better using the Microsoft/IBM Server Message Block protocol and server-based applications like SQL server database engines. These products trade small requests for large replies, thereby reducing the amount of traffic on the network. Hence *LAN Manager* improves efficiency for networks with large data-handling tasks and LAN-to-LAN services.

Both *Lan Manager* 2.0 and *NetWare 386* 3.1 prevent data loss with fault tolerance, UPS interface, and file replication features.

So the issue of throughput has evolved to issues of capacity and functional management. You have to look at the way you use the network and what directions your growth will take. If you need a relatively homogeneous network of PCs with word processing, e-mail, and other typical applications, and little multilocation inter-LAN connectivity, then look both at capable high-end DOS-based operating systems such as LANtastic and at members of the *NetWare* family of products. If you expect to expand to more than 100 users in the same scenario, then look closely at *NetWare 386*.

However, if you plan to use client-server based applications and wide area network links, then the power of the SQL server and the efficiency of the Server Message Block protocols gives *LAN Manager* an edge. Similarly, for large, Unix-based multiserver and multilocation networks—areas where the protocols underlying Banyan's *VINES* produce the most efficient operation—*VINES* merits consideration.

PREVENTING DATA LOSS

Both *LAN Manager* 2.0 and *NetWare 386* 3.1 include three features to ensure against data loss. We'll call them fault tolerance, UPS interface, and file replication. The specifics for each product are described in the reviews.

Fault tolerance helps save data if a disk error should occur and monitors the network for faults. One way it does this is by using data recovery techniques like hotfixing, a method of rerouting data from a disk's bad sectors to good sectors. Both Novell's HOTFIX utility and Microsoft's HPFS perform this function.

The uninterruptible power supply performs orderly shutdowns during power failures. *LAN Manager* uses a standard RS-232 port, but *NetWare 386* requires a special interface. Nevertheless, both are equally well suited to the task.

Finally, a file replication service distributes the data to another server on the network. This feature was to have undergone the greatest changes in the most recent versions of *NetWare 386* and *LAN*

EDITOR'S CHOICE

PC MAGAZINE

• NetWare 386

The normally harmonious LAN Labs crew had some conflicting opinions when it came to awarding the Editor's Choice to *NetWare 386*, Version 3.1, over *LAN Manager* 2.0. The pro-*LAN Manager* contingent argued that Microsoft's product offers robust technology, an excellent price entry point, and a smooth upgrade path. You can start with a $995 five-user system and upgrade to an enterprise-wide network without ever reloading the operating system software and data files.

The pro-*NetWare* LAN Labs faction, stung by the $7,995 entry price of *NetWare 386* and the sloppy jumps from *ELS NetWare* to *Advanced NetWare 286* and on to *NetWare 386*, countered by pointing out the limited number of high-performance servers supported by *LAN Manager*'s OS/2 operating system and the small number of server-based utilities for this new product. Then they asked one probing question: "Would you bet your business by trusting your critical files to a *LAN Manager* network right now?"

The "right now" aspect of the question swung a grudging acquiescence. Even though Novell's pricing has kept *NetWare 386* sitting on distributor's shelves, the product is proven and backed by both a broadly based support system and many third-party products. Microsoft's support system for *LAN Manager* and the software itself don't have a track record, good or bad. However, after a short shakedown cruise, we think *LAN Manager* 2.0 will quickly be ready to carry heavy loads.

We narrowly award Editor's Choice to *NetWare 386*, but if Novell expects to compete in the coming months it will have to turn the *Advanced NetWare 286* cash cow out to pasture, bring down the price of *NetWare 386*, and consider providing a low entry price for administrators who can't immediately spread the cost of the software over hundreds of users.

If you need a network immediately in order to run applications critical to your organization, buy *NetWare 386*. If you want to prove the value of networks and gradually introduce the technology into a workgroup, then *LAN Manager* is a much better choice. ■

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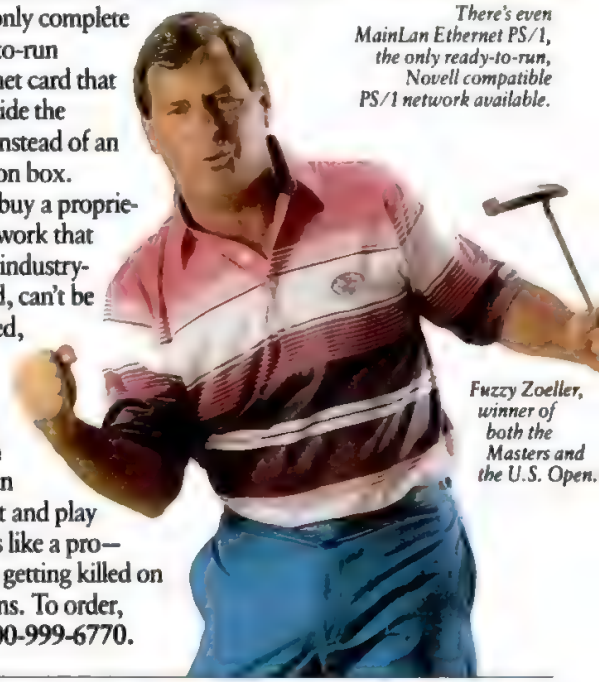

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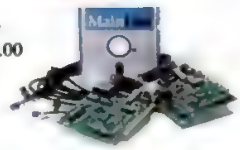

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Manager. However, Novell has not begun shipping it yet.

File replication ensures that two copies of the data exist at all times. Previous methods of creating backups were drive mirroring and drive duplexing. Today there's a third method that creates backups of the data on another server. Microsoft calls it *file replication service;* Novell, *mirrored servers*. These nearly identical features provide the same benefits: they serve as backups to mirrored and duplexed drives.

Mirrored drives and duplexed drives consist of primary and secondary partitions. In both cases, the secondary partition is invisible to the operating system and maintains the same data as the primary partition. The operating system synchronizes the drives to ensure that the data on both partitions remains identical.

Mirrored drives use one disk controller to maintain identical partitions on separate hard disks. The operating systems treat these two drives as one logical disk. Duplexed drives, by comparison, use separate disk controllers. This protects against errors caused by a faulty controller and yields better performance.

A mirrored server—or a file replication service—copies files from one server to another on the network. This method of maintaining data integrity is vulnerable in a way different from the kind of danger that threatens drive mirroring or duplexing. It takes time for files to travel across the network cables; thus if a severe network error occurs before the data gets to the other server, only one copy of the file will exist. For this reason, both Microsoft and Novell use file replication in conjunction with drive mirroring and duplexing.

REMOVABLE MEDIA: NOVELL'S EDGE

In supporting backup systems, Novell beats Microsoft hands down, though both companies have struggled with this problem. Novell's advantage in supporting removable media took years to develop. Microsoft's weakness in this area stems from OS/2's inability to handle some of these systems.

Each company supports removable media differently. Initially, vendors of backup systems had difficulty integrating removable media into *NetWare 386* 3.0. The old system lacked the necessary application program interfaces (APIs) to support devices like tape backups and CD-ROMs. But even though vendors jumped through many hoops to get around this problem, the end product would not work with Version 3.1. Fortunately, 3.1 includes the necessary APIs to support removable media. In addition, the MONITOR NLM (*NetWare* Loadable Module) contains menu options to mount and dismount drives.

OS/2's HPFS does not support removable media, so products like Iomega's Bernoulli box and LaserSafe must operate under the file allocation table (FAT) restrictions. Many people would like to see Microsoft add removable media support to HPFS.

CD-ROMs are another problem for Microsoft's *LAN Manager*. The installable file system (IFS) for CD-ROM support under OS/2 is still not finished. Additionally, the first implementation of LADDR, a drive adapter standard for OS/2 jointly developed by Microsoft, Adaptec, and Western Digital, fails to implement CD-ROMs. This lack of support is surprising for a company whose own CEO, Bill Gates, evangelizes about the benefits and future of CD-ROM technology.

STANDARDS

By using many industry-standard protocols, *LAN Manager* and *NetWare* are able to support many different network topologies on the same network. This fully modular architecture allows concurrent connections to multiple networks. 3Com even allows you to run multiple protocols over the same adapter card (see the sidebar "3Com: Leading the Way in Interoperability").

Two other emerging standards are the Named Pipes protocol and the Microsoft/IBM Server Message Block (SMB) protocol. A Named Pipe allows programs to communicate with programs running on other nodes on the network (see the sidebar "Named Pipes and Client/Server Computing"). This protocol offers a programming interface that is similar to that of NetBIOS, and though its API is somewhat slower, it is also more sophisticated and much easier for programmers to implement.

Most DOS-oriented tasks, such as creating directories or opening files, use short commands and wait for confirmation. Unfortunately, since DOS was de-

NAMED PIPES AND CLIENT/SERVER COMPUTING

by M. Keith Thompson

The Named Pipes protocol is one of a few IPC (interprocess communications) standards. Similar to OS/2 pipes, which are used to redirect interprocess communication within a single computer, Named Pipes redirect interprocess communication and allow applications to use computing resources transparently in other workstations or servers on the network.

While IPX/SPX, NetBIOS, and other protocols require specific knowledge of networking issues, Named Pipes offer a high-level interface in which one command does the work of many more-complex commands. With Named Pipes developers can create genuine network applications quickly and easily; another attraction they offer is multiplatform support.

The Named Pipes protocol developers gives a way to create network applications quickly and easily.

Adhering to this standard ensures that programs are transportable to other operating systems implementing Named Pipes, like Novell's *NetWare* and Banyan's *VINES*. Programs also enjoy added functionality because the operating system takes care of details such as security, administration, and error handling (extra programming is required when using IPX and NetBIOS protocols). The downside is that programs using Named Pipes generally run slower than programs accessing lower-level APIs.

NetWare 386 3.1 supports Named Pipes only on OS/2 clients, but Microsoft's *LAN Manager* 2.0 supports Named Pipes on both DOS and OS/2 workstations. DOS clients, however, must install enhanced workstation software to access Named Pipe calls. ■

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signed long before networks were around, it performs poorly when the device it talks to is on the other end of a network cable. The Server Message Block protocol makes DOS more efficient over networks by converting applications' requests for DOS file services to a shorthand format (see "Server Message Block: DOS Shorthand for Networks," *PC Magazine*, May 29, 1990, page 168).

There is a downside to all of these standards. They take large amounts of RAM, and the layers of translation require CPU horsepower. For example, *LAN Manager*'s enhanced workstation option for DOS clients leaves only 424K of memory for programs—unless you have LIM 4.0 memory, which leaves you 540K for other applications. This option supports Named Pipes, the net APIs, and *Windows* 3.0's NETPOPUP service. Without the support, the basic workstation uses only 51K, leaving 549K for programs.

ONE LITTLE WORD

LAN Manager includes—and Novell has announced—a global naming service similar to *VINES*' StreetTalk. Banyan pioneered the concept of a global naming service in *VINES* (see the sidebar "The Emerging Importance of Banyan's *VINES*"). This service is most useful on large, multiple-server LANs. With one password, each user can have access to all resources on the LAN. In other networking schemes, including *NetWare*, each server keeps its own table of authorized users. Administrators must update each server's table separately, and a person needing access to a specific resource must log onto that server individually.

A global naming service uses a master table to update the servers. Since this eliminates the need to keep track of passwords associated with each resource, it makes administering the network much easier. *LAN Manager* goes one step further by adding the functionality of *VINES*' StreetTalk Directory Assistance (STDA). Using what Microsoft calls the Replicator Service, *LAN Manager* copies the log-on and rights information for each user to the backup domain controllers on the network. Hence, if you log on to a server other than your home server, the network still knows your access rights.

MULTIPROCESSOR SUPPORT

Currently, *LAN Manager* 2.0 is the only file system supporting more than one processor in the server, though Novell and Banyan have both announced plans for multiprocessor support. *LAN Manager* divides the tasks by running server-based applications on one processor and the network protocol and file system on the other. One place multiprocessor support plays an important role is on large busy networks running many print jobs and perhaps an SQL server-based application. While one processor is busy processing requests from the workstations, the other is steadily printing and handling SQL server transactions.

> Before you upgrade your LAN's operating environment, consider cost, the gains made by the products, and the support provided.

Early releases of *LAN Manager* shared a weak print-spooling system with OS/2. They supported only a few printers under OS/2, and some printer drivers didn't work correctly. The print server in OS/2 1.21 not only works, but prints very quickly—particularly in a Systempro equipped with two processors. Our tests show that *LAN Manager*'s print spooler prints data significantly faster than *NetWare*'s NLM print spooler. However, the *NetWare* 3.1 print spooler has also been improved greatly from the earlier 3.0 version.

PROGRAMMING ENVIRONMENT

Contrary to popular belief, Microsoft and Novell implement server-based applications similarly. Microsoft uses OS/2's inherit multitasking capabilities to run many applications on the server. Novell provides developers with an API to write *NetWare* Loadable Modules (NLMs). Each NLM runs as an application on the server under *NetWare*'s supervision. The primary difference between the two is the user interface. OS/2 uses the Presentation Manager GUI, and NLMs use the standard character-based interface. Although PM requires more horsepower to drive the screen than traditional interfaces, it does provide a consistant user interface across each application.

Microsoft contends that OS/2 is a more reliable operating system than *NetWare* for server-based applications because of its memory protection scheme. Programs running on an OS/2 server do not have access to Ring 0 (the kernel) of the 80286 or 80386 microprocessor as *NetWare* NLMs do. This arrangement is supposed to prevent ill-behaved programs from crashing the operating system and stopping all server activities. While this theory sounds good, in practice our computers running OS/2 have crashed as often or even more often than servers running *NetWare*. We think the argument over Ring 0 vulnerability is overblown.

To combat the fear of crashing, Novell instituted a certification program for NLMs and announced plans to provide *NetWare* utilities that monitor and restrict ill-behaved applications. *NetWare* 3.1 includes the first of these utilities, a built-in resource manager and consistency checking facility monitoring all resources within the file server.

NetWare's Multiple Name Space utility—announced, but not shipped in this version—allows files to have more than one name. With more and more applications operating over multiple platforms, like Macintosh and Unix systems, a compatible data file needs to be accessed by different operating systems. To keep data current at all times and save disk space, each operating system can name the same file with its own characteristics.

NetWare handles multiple OS support much better than *LAN Manager*. OS/2's HPFS includes support for extended file attributes but does not allow multiple filenames. All OS/2 files using long filenames are therefore invisible to DOS workstations. For a DOS user to share a data file with an OS/2 user, the OS/2 user must limit the filename to the conventional "filename.ext" (8.3) or copy the file to an 8.3 name. But once two copies of one file exist, you risk using outdated data.

SHOULD YOU UPGRADE?

Before you decide to upgrade or change your LAN's operating environment, consider cost, the actual gains made by the respective products, and the support each company provides. Since *NetWare* 3.0 users receive a free upgrade to 3.1, the only cost associated with the upgrade will be time: Our upgrade from 3.0 to 3.1 took

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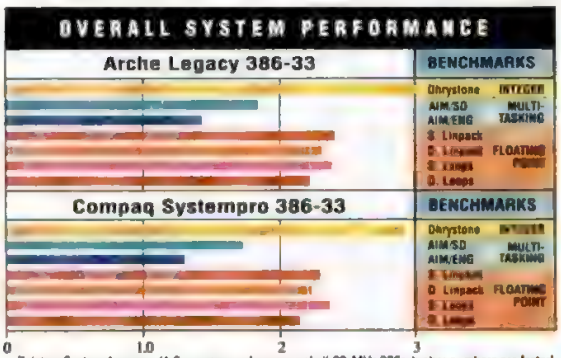

Relative System Averages (1.0=average performance of all 20-MHz 386s-higher numbers are faster).
Source *Personal Workstation Magazine*, May 1990

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MICROLAB 386/25 Price Matrix	Mono-Chrome 12" 720x350	Mono-Flat 14" 720x350	CGA Color 14" 640x200	EGA Color 14" 640x350	VGA Color 14" 640x480	VGA Multi 14" 800x600	VGA Hi-Res 14" 1024x768
30MB 1:1 Interleave	$1695	$1745	$1845	$1995	$2045	$2095	$2195
40MB 1:1 Interleave	$1745	$1795	$1895	$2045	$2095	$2145	$2245
65MB 1:1 Interleave	$1845	$1895	$1995	$2145	$2195	$2245	$2345
80MB 1:1 Interleave	$2145	$2195	$2295	$2445	$2495	$2545	$2645
120MB 1:1 Interleave	$2245	$2295	$2395	$2545	$2595	$2645	$2745
160MB - 1:1 Interleave	$2545	$2595	$2795	$2945	$2995	$3045	$3145
320MB - 1:1 Interleave	$3245	$3295	$3395	$3545	$3595	$3645	$3745

• *Makes a great desktop publishing system!*

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MS-DOS®, UNIX®, OS/2® & Novell® Compatible
Landmark: 35.6 - Norton: 28.2

MicroLab Gives You So Many Extras

ps. No Extras. No Kidding!

What better way to meld functionality, performance and ergonomics.

Solid construction. Flexible design.

Why settle for standard "me too" vendor fare?

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All MicroLab systems come with operations documentation and are easy to use. Should you require personal assistance, our technical support team is staffed by trained, courteous Systems Engineers ready to help. Just a toll free call away.

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We like to think we're just confident.

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No questions. No hassles.

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MicroLab's Commitment

MicroLab is a wholly owned subsidiary of the National Microcomputer Research Institute, an organization dedicated to the advancement of microcomputer technology.

We've evolved into a preferred vendor for government, educational and corporate institutions alike.

We'd like nothing more than to be yours, too.

It's As Easy As Calling 1-800-677-7900

Whether you've got your eye on a pre-configured MicroLab system or need assistance configuring one, call us today.

The call's on us!

MICROLAB™ 386/SX-16 & 386/SX-20

- 2MB RAM-expandable to 8 MB
- 1.2MB 5.25" Floppy Disk Drive
- 1.44MB 3.5" Floppy Disk Drive
- 65MB Hard Disk Drive
- High Speed 1:1 Interleave Hard/Floppy Disk Drive Controller
- 14" Super VGA 1024x768 Monitor
- 16 Bit VGA Adaptor with 512K
- 2 Serial, 1 Parallel & 1 Game Port
- 101 Key Tactile Switch Keyboard
- MS-DOS 3.3 or 4.01

Complete Super VGA 65MB System $1995*

Video Options — Include Monitor & Video Card

MICROLAB 386/SX 16 Price Matrix	Mono-Chrome 12" 720x350	Mono Flat 14" 720x350	CGA Color 14" 640x200	EGA Color 14" 640x350	VGA Color 14" 640x480	VGA Multi 14" 800x600	VGA Hi-Res 14" 1024x768
30MB - 1:1 Interleave	$1345	$1395	$1405	$1645	$1695	$1745	$1845
40MB - 1:1 Interleave	$1395	$1445	$1545	$1595	$1745	$1795	$1895
65MB - 1:1 Interleave	$1495	$1545	$1645	$1795	$1845	$1895	$1995
80MB - 1:1 Interleave	$1795	$1845	$1945	$2095	$2145	$2195	$2295
120MB - 1:1 Interleave	$1895	$1945	$2045	$2195	$2245	$2295	$2395
160MB - 1:1 Interleave	$2295	$2345	$2445	$2595	$2645	$2695	$2795
320MB - 1:1 Interleave	$2895	$2945	$3045	$3195	$3245	$3295	$3395

386 Performance with 286 Compatibility!

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MS-DOS®, UNIX®, OS/2® & Novell® Compatible
Landmark: 21/25.4 - Norton: 17.6/22.0

MICROLAB™ 286/12

- 1MB RAM-expandable to 4 MB
- 1.2MB 5.25" Floppy Disk Drive
- 1.44MB 3.5" Floppy Disk Drive
- 30MB Hard Disk Drive
- High Speed 1:1 Interleave Hard/Floppy Disk Drive Controller
- Hi Res Monochrome Monitor
- Monochrome Video Adaptor
- 2 Serial, 1 Parallel, & 1 Game Port
- 101 Key Tactile Switch Keyboard
- MS-DOS 3.3 or 4.01

Complete Monochrome 30MB System $995

Video Options — Include Monitor & Video Card

MICROLAB 286/12 Price Matrix	Mono-Chrome 12" 720x350	Mono-Flat 14" 720x350	CGA Color 14" 640x200	EGA Color 14" 640x350	VGA Color 14" 640x480	VGA Multi 14" 800x600	VGA Hi-Res 14" 1024x768
30MB - 1:1 Interleave	$ 896	$1045	$1145	$1295	$1345	$1395	$1495
40MB - 1:1 Interleave	$1045	$1095	$1195	$1345	$1395	$1445	$1545
65MB - 1:1 Interleave	$1145	$1195	$1295	$1445	$1495	$1545	$1645
80MB - 1:1 Interleave	$1445	$1495	$1595	$1745	$1795	$1845	$1945
120MB - 1:1 Interleave	$1545	$1595	$1695	$1845	$1895	$1945	$2045
160MB - 1:1 Interleave	$1845	$1995	$2095	$2245	$2295	$2345	$2445
320MB - 1:1 Interleave	$2545	$2595	$2695	$2845	$2895	$2945	$3045

Makes an ideal small business system!

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Landmark: 16.1 - Norton: 13.4

MICROLAB™ XT/12

- 640KB RAM-expandable to 1MB
- 360KB 5.25" Floppy Disk Drive
- 30MB Hard Disk Drive
- Hard/Floppy Disk Drive
- Hi-Res Monochrome Monitor
- Monochrome Video Adaptor
- Serial, Parallel & Game Ports
- 101 Key Tactile Switch Keyboard
- MS-DOS 3.3 or 4.01

Complete Monochrome 30MB System $745

Video Options — Include Monitor & Video Card

MICROLAB XT-12 Price Matrix	Mono-Chrome 12" 720x350	Mono-Flat 14" 720x350	CGA Color 14" 640x200	EGA Color 14" 640x350	VGA Color 14" 640x480	VGA Multi 14" 800x600	VGA Hi-Res 14" 1024x768
30MB - 1:1 Hard Disk	$ 745	$ 795	$ 896	$1045	$1095	$1145	$1245
40MB - 1:1 Hard Disk	$ 795	$ 846	$ 945	$1095	$1145	$1195	$1295
65MB - 1:1 Hard Disk	$ 895	$ 945	$1045	$1195	$1245	$1295	$1395
80MB - 1:1 Hard Disk	$1195	$1245	$1345	$1495	$1545	$1595	$1695
120MB - 1:1 Hard Disk	$1295	$1345	$1445	$1595	$1645	$1695	$1795

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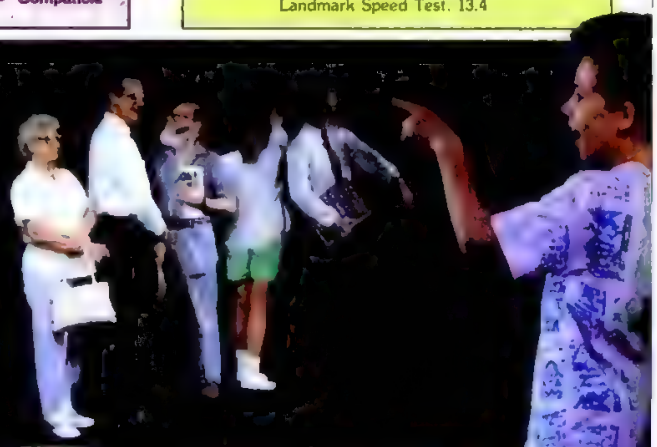

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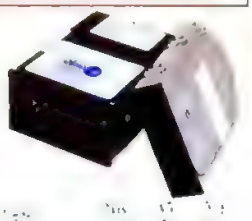
Hard Disk MicroKits

Seagate

K/LOK



Seagate ST225 20MB, 65ms, MFM, HH	178	183	223
Seagate ST238R 30MB, 65ms, RLL, HH	195	200	243
Seagate ST250R 40MB, 68ms, RLL, HH	199	204	249
Seagate ST251-1 40MB, 28ms, MFM, HH	269	274	315
Seagate ST277R-1 65MB, 28ms, RLL, HH	299	304	339
Seagate ST296N 80MB, 28ms, SCSI, HH	399	404	449
Seagate ST4096 80MB, 28ms, MFM, FH	517	522	557
Seagate ST4144R 120MB, 28ms, RLL, FH	569	574	609
Seagate/Imprimis ST4182E 160MB, 17ms, ESDI, FH	949	INQUIRE	
Seagate/Imprimis ST4182N 155MB, 17ms, SCSI, FH	979	INQUIRE	
Seagate/Imprimis ST4350N 307MB, 18ms, SCSI, FH	1399	INQUIRE	
Seagate/Imprimis ST4384E 329MB, 15ms, ESDI, FH	1599	INQUIRE	
Seagate/Imprimis ST2383E 337MB, 16ms, ESDI, HH	1599	INQUIRE	
Seagate/Imprimis ST2383N 338MB, 16ms, SCSI, HH	1629	INQUIRE	
Seagate/Imprimis ST4766E 676MB, 16ms, ESDI, FH	2099	INQUIRE	
Seagate/Imprimis ST4766N 676MB, 16ms, SCSI, FH	2149	INQUIRE	
Seagate/Imprimis ST41200N 1050MB, 17ms, SCSI, FH	3899	INQUIRE	

K/Lok KL320 20MB, 40ms, MFM, HH	169	174	215
K/Lok KL330 30MB, 40ms, RLL, HH	179	184	229
Seagate ST138R 30MB, 40ms, RLL, HH	249	254	295
Seagate ST157R 50MB, 40ms, RLL, HH	275	279	319
Seagate/Imprimis ST1100 88MB, 15ms, MFM, HH	649	654	697
Seagate/Imprimis ST1162N 142MB, 15ms, SCSI, HH	779	INQUIRE	
Seagate/Imprimis ST1201E 177MB, 15ms, ESDI, HH	1029	INQUIRE	
Seagate/Imprimis ST1201N 177MB, 15ms, SCSI, HH	1049	INQUIRE	

MicroLab MicroKits Include:

- Hard Disk Drive
- Dual Drive Controller for XT Kits
- Mounting Hardware
- Bezel & Cabling
- Disk Manager Software for Drives 40MB and Up
- Comprehensive Installation Manual

MicroLab Hard Cards

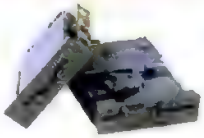
	8 Bit	Lands	SCSI	16 Bit
Hard Card/20 20MB, 40ms	245	265	339	359
Hard Card/30 30MB, 40ms	269	289	359	375
Hard Card/50 50MB, 40ms	349	369	439	539
Hard Card/90 88MB, 15ms	699	719	N/A	829

MicroLab Hard Cards are complete "plug 'n play" high performance hard disk sub-systems. The hard disk and controller card are mounted in-line on a slimline chasis. Mounted in any open bus expansion slot, the unit saves valuable drive bay space for other peripheral devices while minimizing overall system power consumption. 5 minute installation!

Floppy Disk Drives

TOSHIBA

MITSUMI



360KB Floppy 5.25", Black or Beige Bezel	54
720KB Floppy 3.50", Black or Beige Bezel	59
1.2MB Floppy 5.25", Beige Bezel	68
1.44MB Floppy 3.50", Black or Beige Bezel	69

Hard Disk Controllers

WESTERN DIGITAL CORPORATION

Seagate

MFM Controllers

Western Digital XTGEN2PLUS Dual Hard Disk Controller, 8-Bit, 3:1 Int	45
Western Digital 1003VMM2 Hard/Floppy Disk Combination, 16-Bit, 2:1 Int	76
Seagate ST22-M Hard/Floppy Disk Combination, 16-Bit, 1:1 Int	79
Western Digital 1006VMM2 Hard/Floppy Disk Combination, 16-Bit, 1:1 Int	89
Western Digital 1004-A27X Dual Hard Disk Controller, 8-Bit, 3:1 Int	45
Seagate ST11-R Dual Hard Disk Controller, 8-Bit, 3:1 Int	48
Western Digital 1003VSR2 Hard/Floppy Disk Combination, 16-Bit, 2:1 Int	86
Seagate ST22-R Hard/Floppy Disk Combination, 16-Bit, 1:1 Int	89
Western Digital 1006VSR2 Hard/Floppy Disk Combination, 16-Bit, 1:1 Int	99

SCSI Controllers

Seagate ST-01 Dual Hard Disk Controller, 8-Bit, 3:1 Int	39
Seagate ST-02 Hard/Floppy Disk Combination, 8-Bit, 3:1 Int	45
Western Digital 7000FASST Hard/Floppy Disk Combination, 16-Bit, 1:1 Int	299

ESDI Controllers

Western Digital 1007VSE1 Dual Hard Disk Controller, 16-Bit, 1:1 Int	155
Western Digital 1007VSE2 Hard/Floppy Disk Combination, 16-Bit, 1:1 Int	159

Monitors

SAMSUNG

ADC

NEC

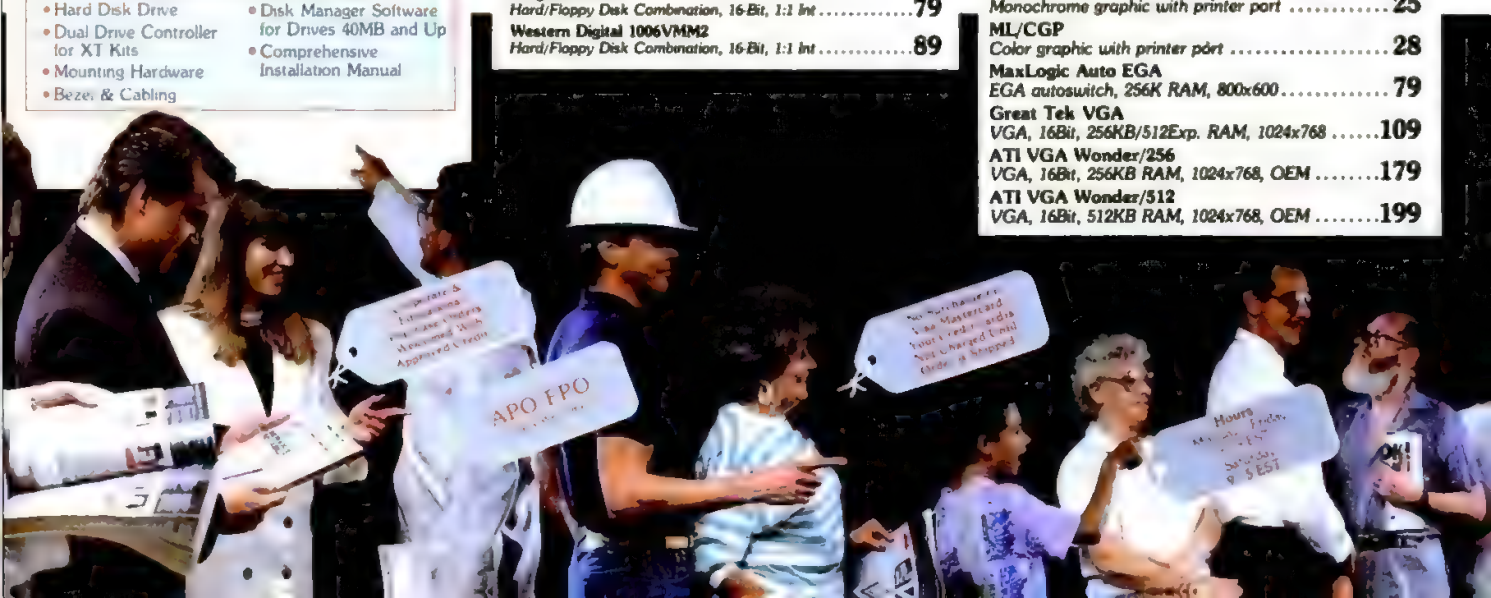
TTL Monochrome 12", Amber, 720x350, tilt/swivel base	65
Amber Flat Screen 14", Amber, 720x350, tilt/swivel base	97
Page White Flat Screen 14", Page White, 720x350, tilt/swivel base	99
VGA Monochrome 14", Page White, 656x496, tilt/swivel base	119
CGA Color 14", 640x240, tilt/swivel base	189
EGA Color 14", 640x350, tilt/swivel base	275
VGA Color 14", 720x400, tilt/swivel base	299
VGA Multi-Scanning Color 14", 800x600, tilt/swivel base	369
Super Hi-Res VGA 14", 1024x768, tilt/swivel base	399
NEC 3D Super Hi-Res VGA 14", 1024x768, tilt/swivel base	599

Video Graphic Boards

MaxLogic

ATI

ML/MGP Monochrome graphic with printer port	25
ML/CGP Color graphic with printer port	28
MaxLogic Auto EGA EGA autoswitch, 256K RAM, 800x600	79
Great Tek VGA VGA, 16Bit, 256KB/512Exp. RAM, 1024x768	109
ATI VGA Wonder/256 VGA, 16Bit, 256KB RAM, 1024x768, OEM	179
ATI VGA Wonder/512 VGA, 16Bit, 512KB RAM, 1024x768, OEM	199



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Printers

Panasonic Office Automation

Panasonic 1180
192cps, 80 col., 9-pin 159
Panasonic 1191
240cps, 80 col., 9-pin 219
Panasonic 1124
192cps, 80 col., 24 pin 279
Panasonic 1624
192cps, 132 col., 24-pin 349
Panasonic 4420
Laser, 8pp. per minute, 22 fonts 899
Panasonic 4450i
Laser, 11pp. per minute, 28 fonts 1299
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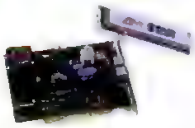
Star NX1000II
144cps, 80 col, 9-pin 159
Star NX1000 Rainbow
144cps, 80 col., 9-pin 199
Star NX1500
192cps, 132 col., 9-pin 279
Star XR1000
300cps, 80 col., 9-pin 299
Star XR1500
300cps, 132 col., 9-pin 409
Star XB2410
240cps, 80 col., 24-pin 429
Star XB2415
240cps, 132 col., 24-pin 549

Modems

CARDINAL TECHNOLOGIES INC

HYUNDAI

STAR

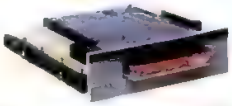


1200 Internal
1200/300 Baud Internal 47
2400 Internal
2400/1200 Baud Internal 75
2400 External
2400/1200 Baud External 89

All modems are Hayes compatible and come complete with user documentation. Internal models include terminal software.

Tape Back-Ups

COLORADO MEMORY SYSTEMS INC



Colorado 60
60/40MB Internal, half-height 245
Colorado 500
500MB Internal, half-height, w/host adapter 989

Tape Back-Ups come complete with data compression and back-up software. PS/2 Kit Add $69. External Kits Add $125. Tape Adapter Cards Add $69.

Chips & Co-Processors

Intel

Intel 8087-3
5Mhz for XT systems 87
Intel 8087-2
8Mhz for XT systems 119
Intel 8087-1
10Mhz for XT systems 149
Intel 80287-6
6Mhz for 286 systems 119
Intel 80287-8
8Mhz for 286 systems 187
Intel 80287-10
10Mhz for 286 systems 209
Intel 80387-SX
SX for 386 systems 279
Intel 80387-16
16Mhz for 386 systems 299
Intel 80387-20
20Mhz for 386 systems 349
Intel 80387-25
25Mhz for 386 systems 445
Intel 80387-33
33Mhz for 386 systems 549

***Ask for current DRAM, SIPP & SIMM pricing!**

Mice & Software

Genius

Genius GM-6X
3 Button, 200-800 DPI w/Dr. Halo 20
Genius GM-6000
3 Button, 350-1050 DPI w/Dr. Halo 35
Genius GM-F302
3 Button, 350-1050 DPI w/Dr. Genius 47
Genius GeniScan
400 DPI, Bus Card w/Dr. Genius 159

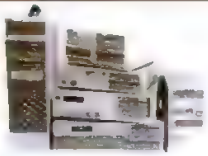
System Componentry

Motherboards

ML/XT-12
4.77-12Mhz, Turbo Motherboard w/CPU 59
ML/286-12
12Mhz, 4MB EMS Motherboard w/CPU 129
ML/386-16SX
16Mhz, Neat-SX Motherboard w/CPU 329
ML/386-20SX
20Mhz, Neat-SX Motherboard w/CPU 499
ML/386-25
25Mhz Motherboard w/CPU 639
ML/386-25 Cache
25Mhz, 64KB Cache Motherboard w/CPU 799
ML/386-33Cache
33Mhz, 64KB Cache Motherboard w/CPU 999
ML/486-25
25Mhz, Cache Motherboard w/CPU 2499

All MicroLab Motherboards come with comprehensive user documentation and set-up utilities.

System Componentry

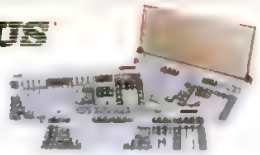


System Cases

ML-XT Case & Power Supply
XT Slide, Turbo/Reset Switches & Power, Disk and Turbo LED's plus 150W Power Supply 69
ML-Baby AT Case & Power Supply
Baby AT, Turbo/Reset Switches & Power, Disk and Turbo LED's plus 200W Power Supply 89
ML-PS/2 Case & Power Supply
PS/2, Slim Workstation, Turbo/Reset Switches & Power, Disk and Turbo LED's plus 200W Power Supply 95
ML-Mini Upright Case & Power Supply
Mini Tower, Turbo/Reset Switches & Power, Disk and Turbo LED's plus 200W Power Supply 99
ML-Full Upright Case & Power Supply
Full Tower, Turbo/Reset Switches & Power, Disk and Turbo LED's plus 230W Power Supply 175

MicroLab system cases are ergonomically styled, two-tone units and come complete with speaker, generous expansion parts supply and 4-lead power supplies.

FOCUS



Keyboards

Focus FK-2001
101-Key, true tactile "click" response, mechanical Alps switch, hinged dust cover/copy holder 49
Focus FK-3001
111-Key, true tactile "click" response, mechanical Alps switch, built-in solar-powered calculator 59
Focus FK-5001
130-Key, true tactile "click" response, mechanical Alps switch, built-in battery operated calculator, both top and left-side 12-key function key layouts, keyboard templates and holder, turbo switch 79

Add-On Cards

FDC-2
Dual Floppy Disk Controller 15
AT I/O
Parallel, Serial & Game Ports 19
XT Multi I/O
Dual Floppy Disk Controller, Clock-Calendar, Parallel, Serial & Game Ports 29
FDC-2 Multi
Two FDC (360/1.2/720/1.44) 29
FDC-4 Multi
Four FDC (360/1.2/720/1.44) Combo 39
XT High Density Multi I/O
Dual Floppy Disk Controller, Clock-Calendar, Parallel, Serial & Game Ports 59

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80/105Mb	**13ms**	N/A	N/A
120/170Mb	**10ms**	N/A	N/A
210/320Mb	**10/12ms**	N/A	N/A
MTBF (Hours)	**60,000**	<25,000	60,000
Compatibility	**PC,PS/2, Macintosh**	PC,PS/2, Macintosh	PC,PS/2 N/A
Capacity Range	**40-320 Mb**	21-44 Mb	21-42 Mb
# Drives on-line	**0-7**	0-2	0-2
Max on-line capacity	**2240Mb**	89Mb	85Mb

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CIRCLE 317 ON READER SERVICE CARD

15 minutes and was trivially easy. *LAN Manager* users have more to think about. If your present *LAN Manager* network works well, is fast enough, and you don't do much printing, you may want to keep it for now: installing the HPFS file system is a big job. For everyone else, *LAN Manager* 2.0 is what you've been waiting for: security, speed, and reliability.

Novell has spent many years developing its distribution network, and *NetWare* is the best selling and most widely known network operating system around. Novell carefully screened its dealers to choose a select few to resell *NetWare* 386. When you have a problem with the product, your local reseller is there to hold your hand. You can also buy a support contract directly from Novell or turn to such *NetWare* resellers such as Gateway Communications for support.

Selling *LAN Manager* to the public is new for Microsoft. To take up the challenge, Microsoft is hiring 500 new employees and spending $60 million in its Networking Business Unit. The company is carefully selecting resellers and doing a first-class job of training them. When you buy a Microsoft-labeled version of *LAN Manager*, your first line of technical support is your dealer. Any user, however, may call Microsoft's technical support line if any unsolved problems remain.

Each *LAN Manager* OEM has its own policy regarding support. Choose the vendor in your area whom you think will give you the best overall help.

LAN Manager 2.0 and *NetWare 386* redefine the capabilities of LAN technology, allowing the implementation of features and benefits previously available only in minicomputer and mainframe environments. However, there is more work to be done. Eventually, Novell's *NetWare* and Microsoft's *LAN Manager* servers could coexist on the same network. 3Com is making headway in this area with *3+Open Connection for NetWare*. Even further down the road, emerging standards and techniques will allow applications to borrow CPU processing power from PCs on an extended network. Finally, many network managers would welcome the convenience of a Remote Program Load standard.

Because today's servers have the computing power of last year's mainframes, these LANs create an environment for powerful enterprise-wide applications and pave the way for tremendous productivity on LANs.

LAN Manager, Version 2.0

What happens when the largest computer company and the largest microcomputer software company get together, for the second time, to create a network operating system? They get it right! IBM and Microsoft met the challenge from a technical standpoint and now face the job of marketing a revitalized version of *LAN Manager*. The product's relatively low price (starting at $995)—and Microsoft's growing experience in supporting products—should help make that challenge easier.

Besides price, *LAN Manager* 2.0 holds two slight advantages over *NetWare 386* 3.1: multiple processor support and global naming services. *LAN Manager* 2.0 is designed to support two processors, but Microsoft sells the support files as options. The global naming services let administrators manage access to multiple servers from a primary domain controller instead of forcing them to make changes at every server.

LAN Manager supports dual processors by running any server-based application on one processor and 386-specific versions of the High Performance File System (HPFS) and the network I/O subsystem on the other. This architecture explains why some speed tests run slower with two processors than they do with one. If *LAN Manager* is the only task running under OS/2, the second processor stands idle.

FACT FILE

***LAN Manager*, Version 2.0**
Microsoft Corp., One Microsoft Way, Redmond, WA 98052-6399; (206) 882-8080.
List Price: For server code and 5 workstations, $995; for additional 10 users, $995; for 1,000 users and no server code, $5,495; for 1,000 users and server code, $6,490.
Requires: Server: 6MB RAM (9MB recommended), 6MB disk space; 80286, i386, or i486-based processor; OS/2 1.21. OS/2 Workstation: 3MB RAM (4.5MB recommended), 5MB disk space; 80286, i386, or i486 processor; OS/2 1.1 or later. DOS Workstation: 512K RAM (640K plus extended or expanded memory recommended), 1MB disk space (4MB recommended).
In Short: *LAN Manager* 2.0 provides many important features for its network OS: excellent security, a fast large-capacity file system, fault tolerance, and multitasking of server-based applications. It's the most powerful network $995 can buy.

CIRCLE 603 ON READER SERVICE CARD

NON-FAT FILE SYSTEM

Wisely, Microsoft departed from the original file allocation table (FAT) system developed for floppy disks more than ten years ago. In those days hard disks for PCs were rare and expensive. Although hard disk drives became economical in the early '80s, patches to DOS lacked enough power to manage large amounts of data efficiently.

The single biggest improvement in *LAN Manager* 2.0 is the increased throughput gained from Microsoft OS/2's new High Performance File System. HPFS caches directories, data, and file system structures, eliminating the need for third-party caching software. Particularly well-suited to very large disk systems, *LAN Manager* 2.0 uses an i386/i486-specific version of HPFS and does not experience significant degradation when processing requests on large directory structures. Like *NetWare 386*, *LAN Manager* 2.0 can handle gigabyte-size files and heavy traffic loads.

HPFS includes many enhanced file system features. Filenames can stretch up to 254 characters long, include spaces, and be case sensitive. However, the entire path of a filename cannot exceed 254 characters. On a mixed DOS and OS/2 network, users maintain compatibility with DOS clients by using the standard *filename.ext* 8.3-character filename, while all files with long filenames remain invisible to DOS workstations. Another feature, extended file attributes (EFAs), supports tighter integration with applications and a more object-oriented environment. These extended file attributes allow information to be associated with a file that goes beyond the simple hidden, read-only, system, and archive bit flags that DOS file attributes support.

BUILT-IN RELIABILITY

LAN Manager now contains built-in fault tolerance, including drive duplexing, disk mirroring, and a new file replication system. These features bring *LAN Manager* up to its peers. File replication allows administrators to duplicate specified files across servers at predefined intervals automatically. HPFS manages bad disk space and

reroutes the data to other sectors, like *NetWare*'s HOTFIX.

When teamed with an uninterruptible power supply, *LAN Manager* protects the server from power failures. Unlike *NetWare*'s special interface, *LAN Manager* communicates with the UPS through a standard RS-232 port. When the power goes out, the UPS signals *LAN Manager*, which in turn sends a warning to everyone logged onto the LAN. If the battery drops below 10 percent remaining life before power is restored, the server shuts down safely.

CONVENIENT FEATURES

Autoreconnect is a big convenience for *LAN Manager* users. If the network goes down, the autoreconnect feature establishes the network connection when the server comes back up. As long as the workstation wasn't expecting something from the server at the moment of failure, the user doesn't know the server went down. Autoreconnect saves the user the effort of logging in again and reexecuting the NET USE command for all of the resources he or she was using.

LAN Manager uses OS/2 Presentation Manager's print spooler, adds support for separator pages, and provides full print spooling services. It supports routing of print jobs to any available printer within a group of similar printers, along with timed delayed printing. Network managers can reprioritize, delete, pause, and continue print jobs, both local and remote, through the OS/2 Print Manager. Print Manager will not let anyone without the proper security level modify a print job. Unlike previous versions of OS/2, Version 1.21's print spooler works nicely.

Microsoft bases *LAN Manager* 2.0's open design on the Network Device Interface Specification (NDIS) codeveloped and copublished by Microsoft and 3Com. Since transport protocols and LAN adapter drivers are written to this standard, interoperability among different vendors' products is both easy and functional. In our recent review of 10BaseT Ethernet adapters, every company reported the availability of NDIS drivers for its hardware.

CENTRALIZED ADMINISTRATION

LAN Manager's centralized server administration features offer several advantages over the server-by-server approach currently available under *NetWare*. Under *LAN Manager*, network administrators can logically group a set of servers together as one domain and administer it as a single server. This allows network managers to change users' rights, passwords, and time restrictions for every server all at once. In contrast, *NetWare* presently requires administrators to change each server one at a time. *LAN Manager* administrators can also safely delegate certain types of management tasks, including disk backup and print queue management, to other people.

Other management tools include a network auditing facility, network statistics and error logging, and autoscheduling

THE LAN MANAGER MIXTURE

by M. Keith Thompson

It's not difficult to mix a LAN Manager 2.0 server with IBM's LAN Server servers, but the subject does require some special attention. Here's help on understanding the issues.

Microsoft is selling *LAN Manager* direct now, but in the past, it was available only through OEMs like IBM and 3Com. Before passing the product on to you, these OEMs made significant additions to the software by adding protocol, disk, and adapter drivers. It really isn't confusing to make most of the different versions on the market interoperate with Microsoft's own offering, but IBM's *LAN Server* variant of *LAN Manager* needs some special attention when it's being put to use in a mixed environment.

In November of 1989, IBM announced that *LAN Server* and *LAN Manager* would eventually come together and look identical. But odds are that many users won't wait for IBM to catch up to the latest release of *LAN Manager*—they want to add *LAN Manager* 2.0 servers to their existing IBM *LAN Server* network right away.

On IBM Token-Ring networks, *LAN Requester*, IBM's *LAN Server* client station software, does not require any modification to run with other versions of *LAN Manager*.

It's a different story for Ethernet networks: Unless you have changed the *LAN Server* default protocol (DIX), you must reconfigure the *LAN Requester* to use the IEEE 802.3 protocol. You also must modify your "PROTOCOL.INI" and "LANMAN.INI" files so that they find the proper options.

LAN Manager 2.0 and *LAN Server* implement domains and log-on security differently. Because of this, servers in a domain must run the same network operating system, with the exception of *LAN Manager* 2.0 stand-alone servers. Since stand-alone *LAN Manager* servers don't participate in log-on security, they can simply be added to a domain containing *LAN Server* servers. While *LAN Requester* workstations can "LOGON" only in domains running *LAN Server*, once they have logged on, they can use resources from any domain. Conversely, *LAN Manager* 2.0 workstations can "LOGON" in any domain.

Making connections to resources is straightforward, with one small exception. *LAN Manager* 2.0 workstations do not understand aliases, the special nicknames *LAN Server* assigns to shared resources.

LAN Manager 2.0 workstations, however, can still use these aliases by specifying the full network path assigned to the alias with the "NET USE" command.

Since DOS workstations use the null print driver, there are no problems printing on a *LAN Server* server from a *LAN Manager* 2.0 workstation and vice versa. Unfortunately, printing is not as simple when an OS/2 workstation is involved. It can be done, but it will require some specialized help from Microsoft or your *LAN Manager* reseller. ■

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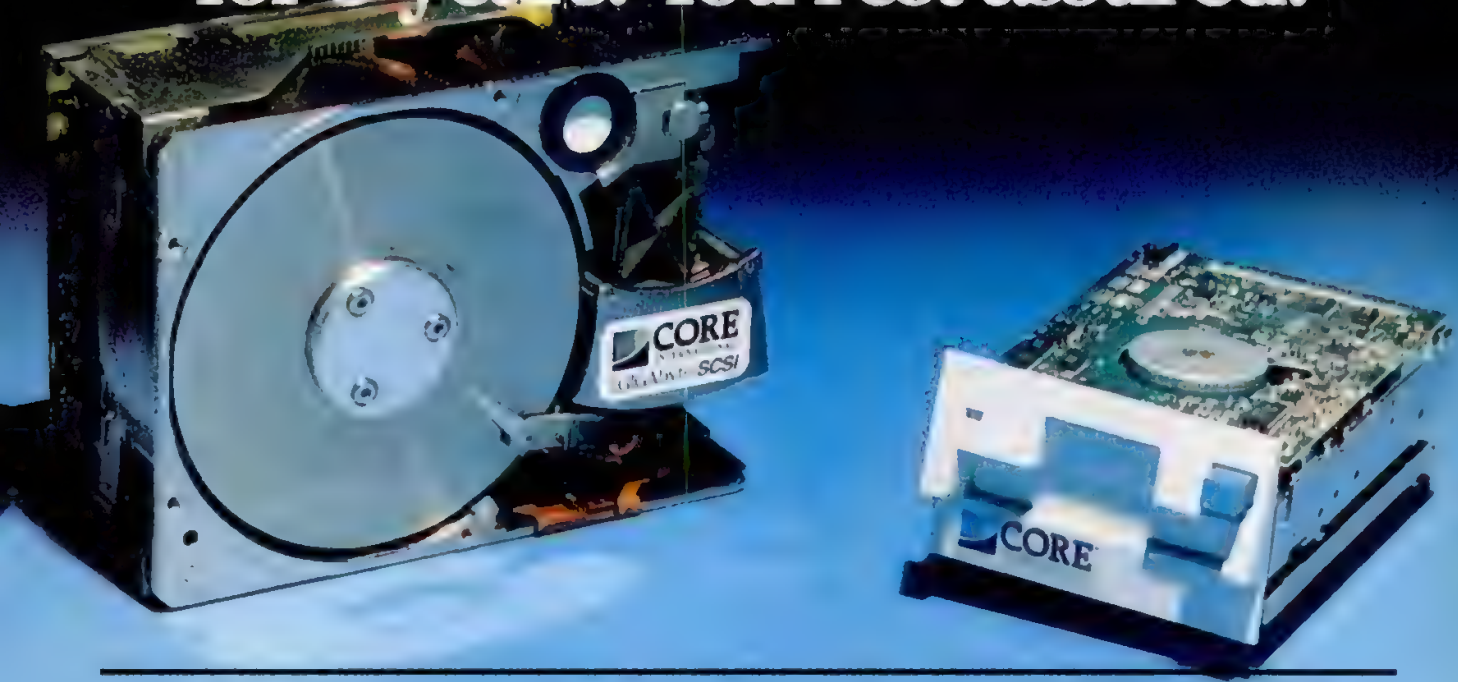

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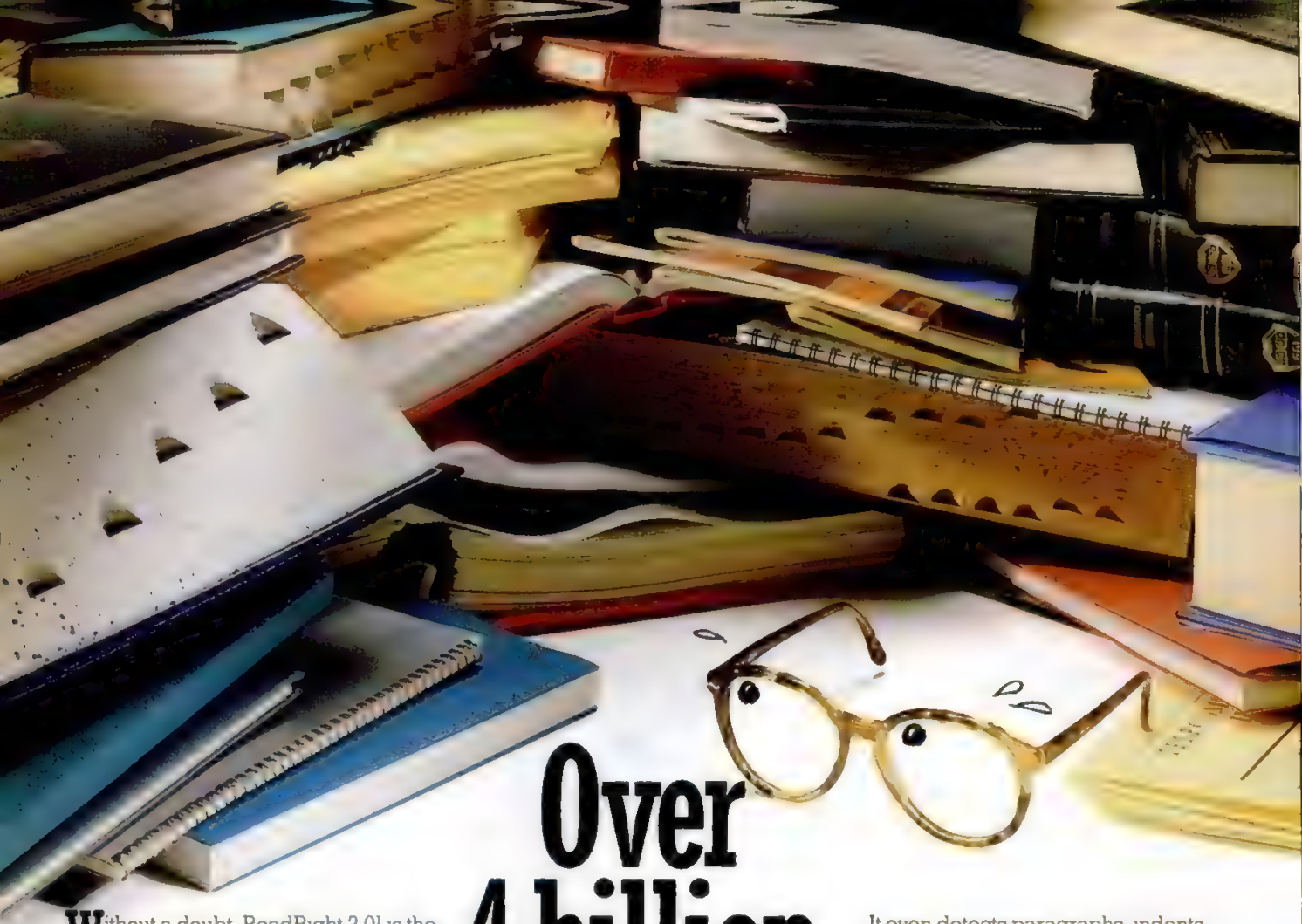

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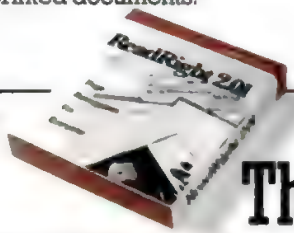

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of events. With the network auditing facility, managers can monitor the use of any network resource. The error-logging facility helps administrators find trouble on the LAN. The autoscheduling utility tells the server to do things at a specific time each day or month. It can send messages and run programs at preset intervals, freeing the administrator to do other tasks. *LAN Manager* 2.0 also includes a self-tuning memory management facility like the one in *NetWare 386*. This feature dynamically reallocates memory buffers, allowing the server to give the best response time.

Easy to use from both ends of the network, *LAN Manager* presents its SAA-compliant menu-driven interface to system administrators and users alike. With most of the documentation on-line, manuals are rarely necessary, and context sensitive help pops up at the touch of the F1 key. Despite Microsoft's GUI fever, the system offers the pleasant flexibility of a command line equivalent for each menu option. This allows power users to execute network commands from DOS or batch files.

COMPREHENSIVE SECURITY

LAN Manager's comprehensive security system addresses all components of the network and is as complete as any on the market—a major improvement over earlier releases. The security utilities allow close control over end-user access to the system. Through the Remote Administration facility, network managers can perform all administration chores from any OS/2 client workstation on the network.

With *LAN Manager*'s Account Control, administrators set valid log-on times, valid workstation IDs, and account expiration dates. The forced log-off option allows managers to force users off the network if they exceed their storage limit or their account expires.

Originally, a *LAN Manager* 1.*x* server had no local security. Anyone with access to the physical computer could boot from an OS/2 floppy and access all the files on the hard disk. Now with HPFS386, *LAN Manager*'s special version of HPFS designed for i386/i486 processors, system administrators can choose the type of security they wish to use for the file system. The setup program's Local Security option limits hard disk access to users with the proper passwords. Before anyone can access the hard disk (even if *LAN Manager* is not running), it's necessary to

LAN MANAGER 2.0 VS. NETWARE 386 3.1: SUMMARY OF FEATURES

	LAN Manager, Version 2.0	NetWare 386, Version 3.1
List price	$6,490	$7,995
GENERAL INFORMATION		
Peer-to-peer resource sharing	■	■
Nondedicated server option	■	■
Number of users at stated price	1,000	250
SERVER OPERATIONS		
Special hard disk format	HPFS	Proprietary
Fault tolerance	■	■
Maximum number of network cards bridged	12	64
Maximum number of simultaneous log-ons	1 000	250
SERVER SOFTWARE		
Requires another operating system	OS 2	DOS
Allows disk caching	■	■
Dynamically self-configures cache buffers	■	■
RAM required	5MB	3MB
RAM recommended	9MB	6MB
WORKSTATION SOFTWARE		
RAM available for applications	549K	636K
RAM available with NetBIOS	549K	516K
Compatible with OS/2 workstations	■	■
RAM recommended for OS/2 workstations	3.5MB	3.5MB
Autoreconnects	■	□
FILE SYSTEM		
Concurrent open files per server	16,000	100,000
Volumes per server	26	64
Physical drives per volume	24	32
Physical drives per server	24	1,024
File can span multiple drives	■	■
Maximum file size	2GB	4GB
Maximum volume size	2GB	32TB
Maximum physical RAM	16MB	4GB
Maximum disk storage	48GB	32TB
ADMINISTRATION		
Keeps historical error/status log	■	■
Keeps accounting data by user or resource	■	■
Adds or deletes resources while network runs	■	■
Reports number of bad packets	■	■
Reports network errors	■	■
Monitors open files	■	■
Shows names of users logged on	■	■
Shows percentage of server being used	□	■
SECURITY		
Can use group membership to determine resource access	■	■
Can associate passwords with resource names	■	■
Sends encrypted passwords over network	■	■
Can grant access by level	■	■
Allows access control by time and date	■	■
PROGRAMMING TOOLS AVAILABLE		
Software development kit	■	■
Complete application program interface (API)	■	■
Complete 32-bit tools and environment	□	■
Named Pipes	■	■
Mail slots and sockets	■	■
PRINTING		
Handles print spooling	■	■
User can modify print queue	■	■
Number of printers supported	Unlimited	Unlimited
Workstation printers supported	■	■
Allows downloading of fonts	■	■

★–Editor's Choice ■–Yes □–No MB–megabytes, GB–gigabytes, TB–terabytes

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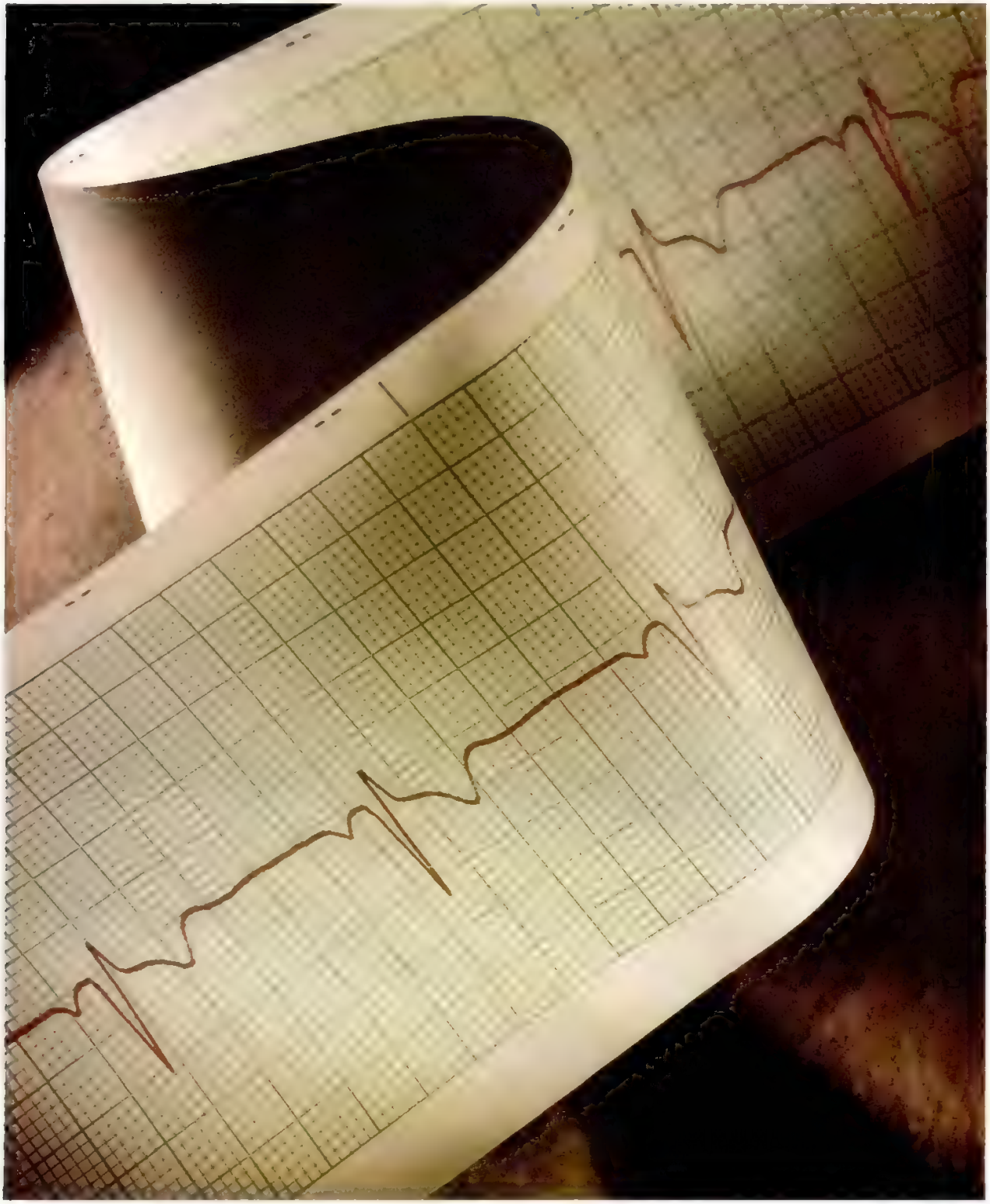

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log on locally. Even without the Local Security option set, HPFS386 stores access permissions for each file and directory within the file's own extended attributes. This prevents someone from looking at data on the disk with standard HPFS.

UNCOMPLICATED INSTALLATION—USUALLY

Before adding users to the network and installing software, you must give careful consideration to network design. The documentation helps you decide how to set up your network, explaining the different security options and how the log-on service works.

Installing *LAN Manager* 2.0 does not require a Ph.D. in computer science, but it's not simple. Since *LAN Manager* uses OS/2 1.21, you must first install the operating system and then run a utility called Setup to install the network software. The menu-driven Setup program asks some simple questions about your server's configuration. On our NCR PC486/MC33, the entire installation took only 45 minutes, including formatting the super-fast 320MB SCSI hard disk with HPFS.

Without a hard disk, *LAN Manager* 2.0 setup is more difficult. The documentation doesn't explain how to install software on floppies.

On the client PCs, installation is just as easy—*if* you have a hard disk on every would-be client station. If a client PC doesn't include a hard disk, however, *LAN Manager* 2.0 setup becomes more difficult. The documentation does not explain how to install the software on floppy disks. If you contact Microsoft or *LAN Manager* resellers like 3Com and AT&T, they can explain how to install the workstation software on 3.5-inch and 1.2MB 5.25-inch diskettes. Nevertheless, floppy disk installation still takes more time and is more complicated, and the software will not fit on 360K floppies.

It's a little easier to install diskless workstations under *LAN Manager* 2.0 than under *NetWare*. *LAN Manager* lets each computer have its own AUTOEXEC.BAT file, and each user can have a separate log-on batch file. In contrast, *NetWare*'s log-in scripts offer more functionality than normal DOS batch files, but users and administrators must learn a few more steps to use them.

3COM: Leading the Way in Interoperability

by M. Keith Thompson

3Com, the number-one *LAN Manager* reseller, offers the widest range of connectivity options and essentially gives corporations one-stop shopping. The *3+Open* operating system software, Ethernet adapters, gateways, routers, and wiring systems are only a few of the company's products. As *LAN Manager* 2.0 continues to gain acceptance, look to 3Com to provide interoperability with other network operating systems, such as *NetWare*—as well as with minicomputers and mainframes—on the same network.

3Com's first release of *LAN Manager* 2.0 (known as *3+Open* 2.0) will include only a few of the many value-added services found in *3+Open*. Version 1.1 (*LAN Manager*, Version 1.1). In the meantime, 3Com will continue selling *3+Open* 1.1 with enhancements not found in 2.0, including 3Com's gateways and routers, as well as support for XNS, TCP/IP, and AFP protocols.

One of *3+Open*'s most powerful additions to *LAN Manager*—present in both 1.1 and 2.0—is Demand Protocol Architecture (DPA). DPA allows DOS users to take advantage of the industry-standard protocols—IPX, XNS, NetBEUI, and TCP/IP—for better multiplatform connectivity. *3+Open* loads the protocols when needed and then unloads them automatically to optimize memory use. The only protocol that *3+Open* 2.0 supports is NetBIOS.

3Com's LAN Manager implementations let users take advantage of industry-standard protocols like IPX, XNS, NetBEUI, and TCP/IP for better multiplatform connectivity.

3+Open Connection for NetWare is also available in Versions 2.0 and 1.1 of *LAN Manager*. This software allows DOS-based workstations to communicate simultaneously with *LAN Manager* and with both *NetWare 386* and *NetWare* 2.15 servers; DOS clients can access file and print services on all servers without regard to the host operating system. (While this service works with all versions of *LAN Manager* 2.0, 3Com does not license the software separately.)

3Com accomplishes this trick of working with both operating systems by loading an unmodified Novell IPX protocol stack and the *NetWare* shell on top of the same NDIS adapter driver that supports *LAN Manager* and other DPA capabilities. No shell emulation is necessary in this case because native *NetWare* client software is used to access *NetWare* servers.

NetWare workstations use the IPX communication protocol to talk to *NetWare* servers. Cleverly, 3Com creates an NDIS-compliant IPX driver by linking an IPX-to-NDIS translation program to the *NetWare* IPX object file created during shell generation. After the program is linked, the driver loads and unloads through the services of DPA. With DPA, *3+Open* allows *LAN Manager* users to use *NetWare* servers only when needed and then unload the IPX protocol, freeing memory for other DOS applications.

3Com offers the most comprehensive support and network integration services of any *LAN Manager* vendor. Its fully enhanced version of *LAN Manager* 2.0, which will include all the features now present in its 1.1 version and is scheduled to ship in mid-1991, promises to be another winner in the line. ■

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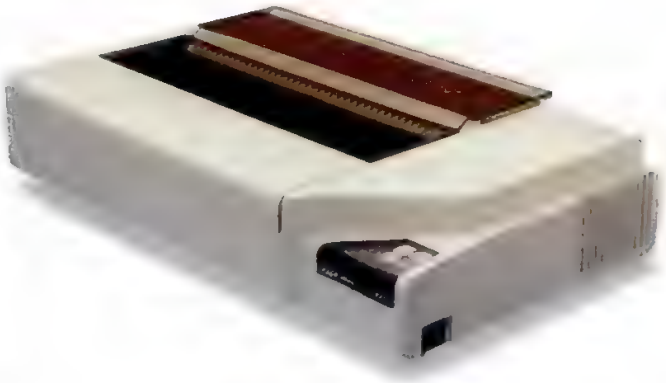

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CIRCLE 245 ON READER SERVICE CARD

Although *LAN Manager* 2.0 will run on an 80286-based server, we do not recommend it. Without an i386/i486 processor, you lose both performance and local security. *LAN Manager* will reach its greatest potential when linked with a 32-bit operating system.

STEP-BY-STEP UPGRADING

Upgrading from an earlier version of *LAN Manager* presents little difficulty but requires close attention to the instructions. The manual's step-by-step explanation leads you through each of the six necessary operations.

As with any major upgrade, you must be sure to back up all of the data on your server before starting, so first save your current configuration information and your entire server to a removable medium. Second, with the existing Setup program, remove the old version of *LAN Manager*. Third, install OS/2 1.21 and format the hard disk with HPFS. Fourth, restore your backed-up server data. Fifth, install *LAN Manager* 2.0 with the new Setup program. Finally, with the "PORTACC" program, convert the previous user accounts database and resource permissions to *LAN Manager* 2.0 format.

NEW SALES CHANNELS

For new installations, Microsoft priced *LAN Manager* 2.0 brilliantly: You pay as

TESTING THE HOTTEST AND THE FASTEST

by Frank J. Derfler, Jr.

It's an article of faith in the auto industry that road racing produces better cars. The data collected and the experimentation done during a race feeds back into the design of more-common highway iron. Similarly, we learned a lot from testing *NetWare 386* and *LAN Manager* that you can use to benefit your organization's network.

Here are some of our top-line conclusions: After you make sure that your server has a fast hard disk and enough memory for disk caching, put two or more network adapter boards in the server and split the network cabling to even the average load. This simple operation will give you an impressive payoff in throughput. Another conclusion: Encouraging end users to use local printers rather than network-connected printers will speed up throughput for everyone.

Our experimentation proved that servers made from combinations of burly hardware and specialized software have lots of throughput left even after they fill an Ethernet cable to 70 or 80 percent of capacity. You need more LAN capacity than a single Ethernet link can provide to tax the server's capabilities.

THE TESTS

To keep our test results consistent with past issues, we ran our usual **Hard Disk Access Load** test from the standard suite of PC LAN Labs benchmark tests. This test is still evolving, however, and we are now in the beta cycle of a new test version that will produce even more rigorous operation. (For a description of Network Throughput Under Load test results, see *PC Magazine*, September 25, 1990, page 35.)

We added a new task to the benchmark test activity in order to more closely simulate the use of a server in a modern organization and to load the server more heavily. This task involved placing a 1MB print job into the server's printer spool. We then ran our tests as the server fed the print job to a Hewlett-Packard LaserJet attached to the parallel port. This print job took between 5 and 7 minutes to move to the printer, so we had sufficient time to run the throughput tests simultaneously.

THE LOAD DATA

In addition to our servers, we used an assortment of 15 PCs as client stations, as well as a sixteenth machine that we used for testing performance. The 15 load machines generated the flurry of activity shown in the box labeled Load Data. This chart shows the number of bytes moved through the network cable by the 15 load machines during 1 minute while the server also fed an attached printer a large print job. Our Network General Sniffer collected this data over a run of several minutes and then averaged the results.

We present this Load Data box primarily to illustrate the amount of work done by the load stations. These load stations kept the Ethernet system running at 70 to 80 percent of maximum capacity—something seldom if ever found even in installations with hundreds of nodes. The main benchmark test charts show the throughput achieved by a separate station running a different set of data-handling tasks while these stations load the network.

SPLITTING THE CABLE

We divided our LAN cabling by putting all the load stations on one cable and one adapter in the server. Next we took the PC that we used to measure performance and placed it on its own Ethernet cable, which was connected directly to a dedicated adapter in the server. This arrangement eliminated contention on the Ethernet segment used by the performance-measurement PC and moved the contention into the server's data bus and disk cache subsystem. The improvement in throughput experienced by the station on the separate cable was substantial.

The throughput tests for 5, 10, and 15 stations with no print job were all developed using two adapters in each server. For illustration, we also included a throughput test with a load of 15 stations plus the performance-measurement PC on the same cable and server network adapter. The slower numbers for this test reflect not degradation in the server but the increased difficulty that the performance-measurement PC had in getting to the host through the busy cable and adapter.

We also tested the same 15-station load on the single cable and adapter under the added simultaneous load of the print job moving from the server to the printer. Here we found that throughput dropped considerably–anywhere from 13 to 65 percent, not including the NCR server running *NetWare 386*, which refused to function on this test. The final column shows the same load on the server, but with the performance-measurement PC connected to the server through its own cable and adapter.

CONTINUES

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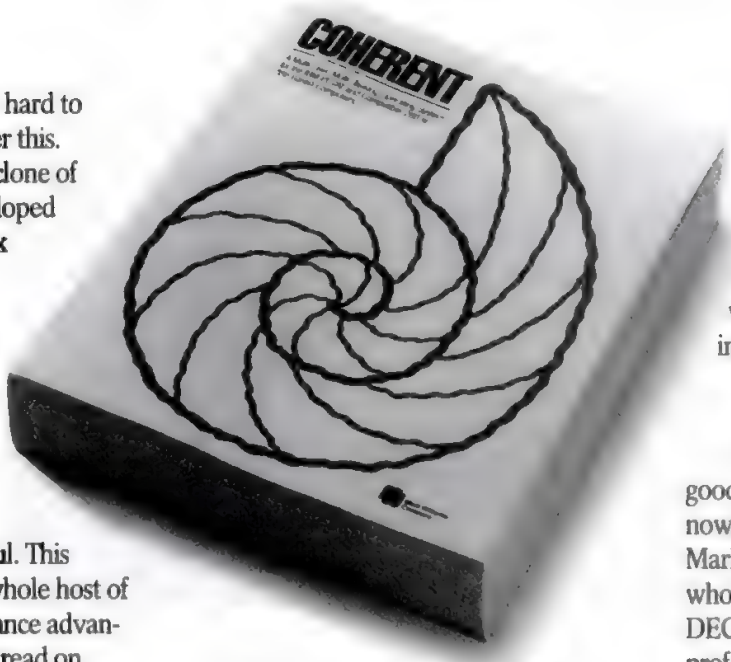

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Performance*	38.7 sec	100.3 sec
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BENCHMARK TESTS: LAN MANAGER 2.0 VS. NETWARE 386 3.1

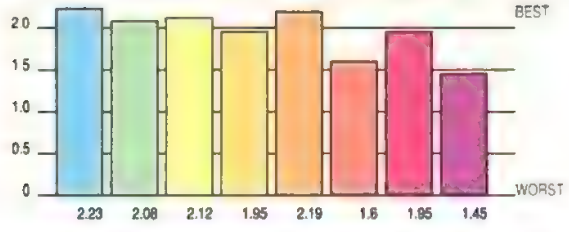
Little difference exists between *LAN Manager* 2.0's and *NetWare 386* 3.1's throughput; however, they handle information differently. *LAN Manager* moves data more efficiently in large chunks, making it more useful for functions such as LAN-to-LAN communication *NetWare 386* excels in moving smaller packets around the network—the way most applications are still designed.

The Hard Disk Access Load test heavily loads the hard disk and disk-caching system. Each load station randomly accesses its own 110K data file using 1K records, changing the data each time, while the timed station transfers files. This test is sensitive to the algorithms used in the cache scheme, the software's efficiency in handling the drive, and the speed of the drive and controller.

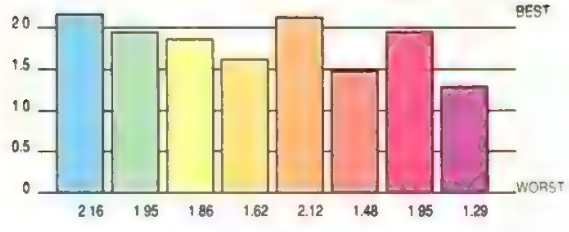
We added a 1MB print job to the server's print spool in order to more closely simulate the use of a server in a modern organization, then ran the Hard Disk Access Load test while the server fed the 5- to 7-minute task to a Hewlett-Packard LaserJet attached to the parallel port.

Hard Disk Access Load — Throughput *

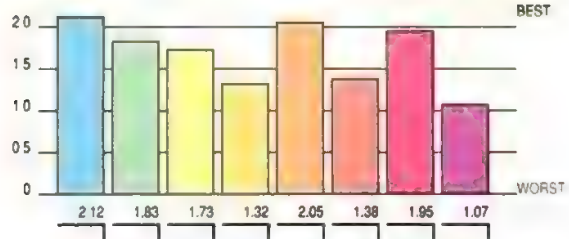
No load (two adapters)



5 stations (two adapters)



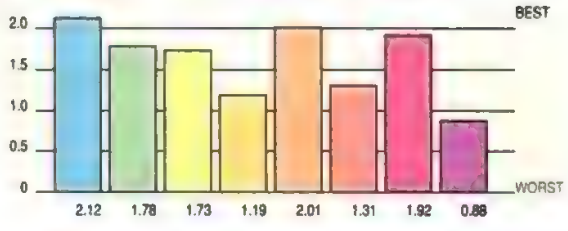
10 stations (two adapters)



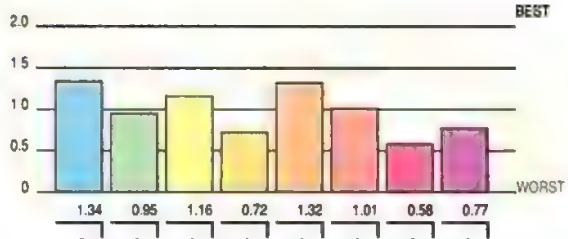
Network operating system / Server and adapter
NetWare 386 ALR PowerCache, Novell NE2/32 32-bit
NetWare 386 Samsung A3, Western Digital 8013EBT 16-bit
NetWare 386 Core Affinitor, Western Digital 8013EBT 16-bit
NetWare 386 IBM PS/2 Model 80, Novell NE2/32 32-bit
NetWare 386 NCR S486 MC32, Novell NE2/32 32-bit
LAN Manager NCR S486 MC32, 3Com 3C523 16-bit
NetWare 386 Compaq Systempro, Novell NE3200 32-bit
LAN Manager Compaq Systempro, Novell NE3200 32-bit

Hard Disk Access Load — Throughput *

15 stations (two adapters)



15 stations (one adapter)



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NetWare 386 Compaq Systempro, Novell NE3200 32-bit
LAN Manager Compaq Systempro, Novell NE3200 32-bit

* Megabits per second.

Our test suite for the comparison between *LAN Manager*, Version 2.0, and *NetWare 386*, Version 3.1, involved the use of 16 PCs. The mix included seven with 80286 processors operating at 12 MHz or better, seven with 80386 processors operating at 16 MHz or better, and one 486 machine running at 33 MHz. Fifteen of the machines ran load tasks that worked the server's disk-caching and hard disk system. The sixteenth machine, a Compaq Deskpro 386/20, operated as the separate performance-measurement machine.

For servers, we lined up an impressive array of heavy computing power, including:

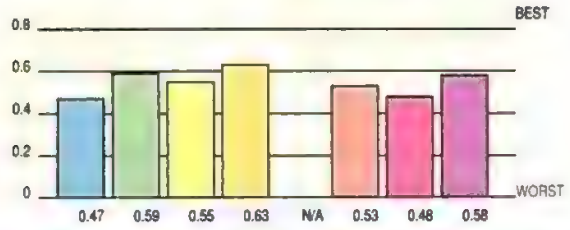
- A Compaq Systempro with dual 80386/33-MHz processors and the Compaq Hard Disk Array. In this configuration, the Systempro carries a retail price of $33,095.
- An ALR PowerCache Model 33/4 with a 486/33 processor and an EISA bus with dual 320MB hard disks. This unit carries a retail price of $16,803. Unfortunately, the company providing OS/2 driver software for the Adaptec disk controller in the ALR wasn't able to deliver the software in time for us to complete testing of *LAN Manager* with this computer.
- The NCR S486/MC33, with an 80486 processor operating at 33 MHz in an MCA bus. The price for this machine as tested with a single 340MB hard disk is $26,195.
- A Core ATomizer 386T with two 310MB hard disks and a 386 processor operating at 33 MHz in an ISA bus. This unit carries a $14,400 price tag as tested. *LAN Manager* drivers were not available for this machine's hard disks when we tested it.
- A Samsung A3 file server with a 386 processor operating at 33 MHz and a 320MB hard disk in an ISA bus. This computer, in the configuration we tested, has a retail price of $11,739; however, drivers for *LAN Manager* were not available for this machine.
- Our veteran IBM PS/2 Model 80 MCA machine, with its 80386 processor stumbling along at 20 MHz, but treated to a $3,295 upgrade: a Core P60310 315MB hard disk and controller. *LAN Manager* drivers were not available for the Core at the time of testing.

Since Microsoft does not yet have the software drivers to use Novell's 32-bit MCA adapters, when testing the MCA machines we used Novell's NE-232 32-bit network adapter for *NetWare* and a 3Com 16-bit MCA controller for *LAN Manager*. Purists will argue that this is not a direct comparison; however, practical people will realize that it's senseless to hamstring *NetWare 386* because of *LAN Manager*'s limitations. Microsoft did provide *LAN Manager* drivers for Novell's 32-bit EISA network adapter.

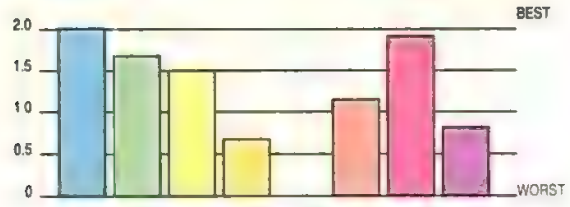
Hard Disk Access Load with Print Job

Throughput*

15 stations (one adapter)



15 stations (two adapters)



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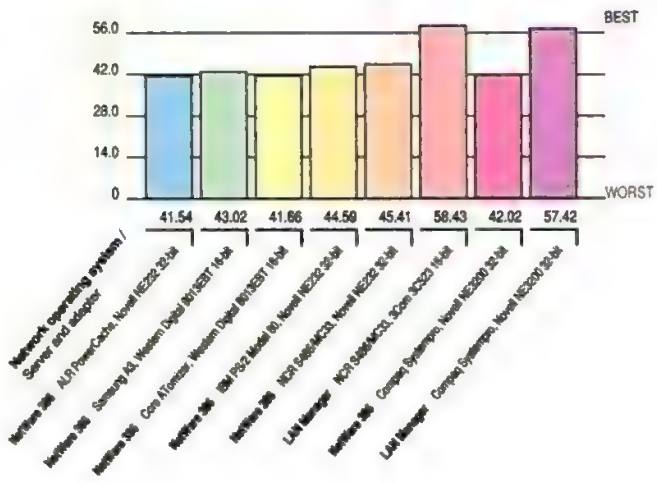
LAN Manager NCR S486/MC33, 3Com 3C523 16-bit
NetWare 386 Compaq Systempro, Novell NE3200 32-bit
LAN Manager Compaq Systempro, Novell NE3200 32-bit

Load Data

Take care in interpreting the data in this table. The PCs acting as client stations generated the load by reading and writing 1K blocks in individual 100K files—not an uncommon activity for PC application programs—but at a rate 10 to 20 times as fast as a typical application.

The servers running under *LAN Manager* moved more bytes of data across the network cable than those running under *NetWare 386*, but took many more packets to do it. Many of the bytes going through the cable were really overhead from the added packets rather than data for an application program. This is the primary reason *LAN Manager*'s throughput improves when an application calls for data in larger blocks, as is the case with LAN-to-LAN communications, for instance. With more application data in the packets, the ratio of useful data to overhead improves.

Load Data (megabytes per minute)



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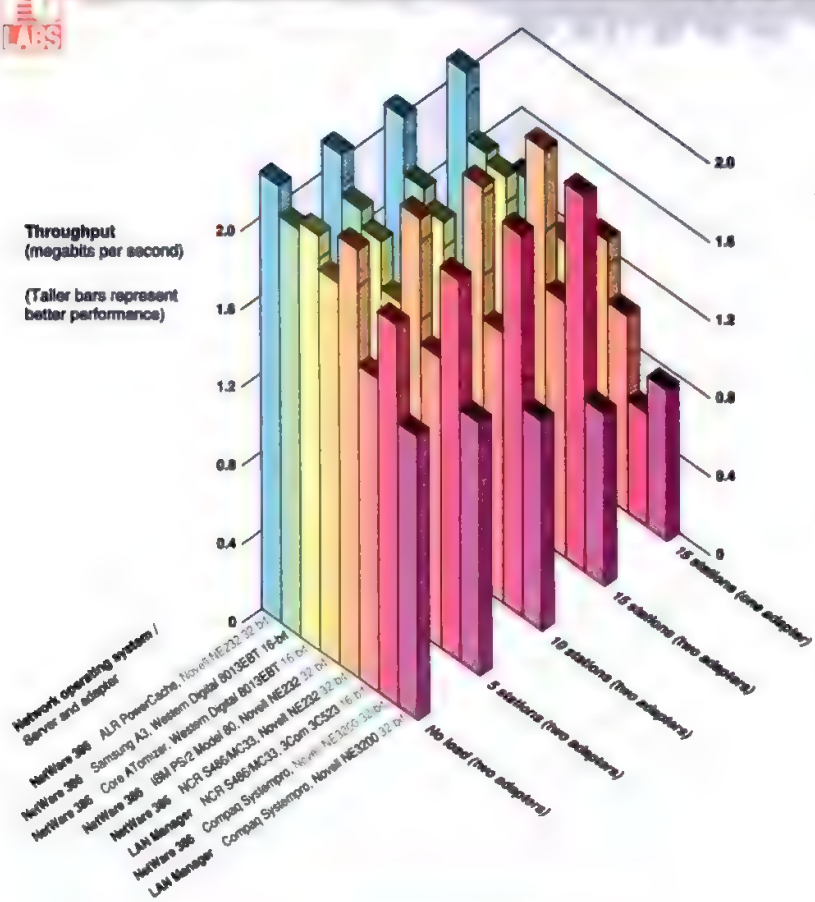
NetWare 386 Compaq Systempro, Novell NE3200 32-bit
LAN Manager Compaq Systempro, Novell NE3200 32-bit

* Megabits per second.

N/A: The NCR S486/MC33 was unable to perform this test.

CONTINUES

COMPOSITE VIEW: HARD DISK ACCESS LOAD



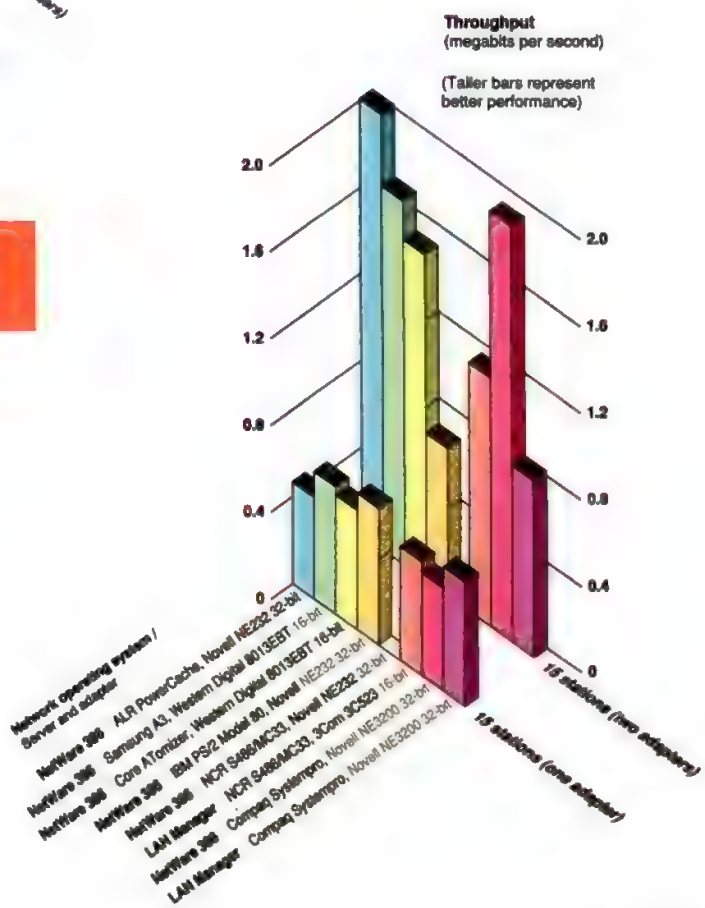
We found only a few throughput differences **between** *LAN Manager* and *NetWare 386*. **The main** difference is that *LAN Manager* **puts many** more packets on the network **than** *NetWare 386* does to accomplish an **equivalent amount of work.**

LAN Manager **showed less** throughput than *NetWare 386* in our tests because *LAN Manager* slows down when the testing program moves data in blocks of 512 bytes. Most applications still typically move data in blocks of 1K or less, but if your applications move data in bigger blocks, you will see very different results. Note, however, that the PC we used to measure performance saw throughput of over 1.1 megabits per second from even a heavily loaded *LAN Manager* server. This is plenty of throughput for everyone but the power user with gigabytes of data to send.

COMPOSITE VIEW: HARD DISK ACCESS LOAD WITH PRINT JOB

Handling a steady stream of print jobs slows down network performance considerably. However, the significantly improved print spooler in *LAN Manager* 2.0 moves print jobs out at a steady clip, with or without a second CPU in the server handling print job activity. We also saw substantial improvements in the throughput at the end stations by splitting the load among multiple server adapters.

Unfortunately, for reasons that were not resolved before publication, the NCR S486/MC33 locked up under the strain of a print job. It seems obvious that this new machine had a glitch in its I/O software or firmware. Until this final test, both this 486 and the ALR 486-based machine were closely paced. Note, too, that the heavy load of feeding both adapters and servicing the print job seemed to curb the enthusiasm of our PS/2, with its 20-MHz CPU.



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CIRCLE 146 ON READER SERVICE CARD

you grow. For $995 you get the server software and five workstation licenses. Each additional ten-user license costs $995; alternatively, you can get a 1,000-user version for $6,490. This pricing scheme accomplishes two things: It makes the cost per user for large networks extremely affordable, and it provides an entry point into high-power network computing.

In the past, Microsoft sold *LAN Manager* only through OEMs like IBM, 3Com, and NCR. Microsoft supplied the core product; OEMs customized it. With *LAN Manager* 2.0, Microsoft offers a shrink-wrapped version of the software that's ready to run right out of the box, available from retail dealers throughout the country. To boost the effort, Microsoft is recruiting many new employees specifically to handle *LAN Manager* support calls and dealer training.

When choosing your *LAN Manager* vendor, keep in mind that the underlying software is the same and that in most cases each company gears *LAN Manager* to solve different integration problems or to have a specific appeal. For example, 3Com's *3+Open LAN Manager* adds the ability to run multiple adapters over the same network card and offers connections to *NetWare* networks. IBM's flavor of *LAN Manager* permits connections to IBM hosts. If you want to use *LAN Manager* but don't have any special system integration needs, choose the company with the best track record for support.

With *LAN Manager* 2.0, Microsoft moves into a heated race for top spot in the LAN operating system market. The server-based applications and global naming services available today in *LAN Manager* put it ahead of *NetWare* in some aspects. Microsoft now offers a fast, feature-rich, and secure network operating system, providing an excellent platform for future computing needs. Finally, competition for *NetWare*!

NetWare 386 3.1

Everyone agrees that Novell holds the lion's share of the PC LAN market, mainly because *NetWare* has been widely judged the first, fastest, and best LAN operating system for serious applications. *NetWare* has consistently shown itself to be the fastest performer, while including the management and operational features most needed in a modern file-server operating system. With the new version's speedier file system, support for removable storage media, enhanced support for add-on modules, easier installation, and more complete error reporting, the $7,995 *NetWare 386* offers many worthwhile extra capabilities.

THE REAL NETWARE 386?

Novell pioneered the LAN in the early '80s and, with *NetWare 386* 3.0, the company continued to break new ground. But *NetWare 386* 3.0 functioned merely as a warm-up for Version 3.1. Novell brought its next-generation operating system to market before it included all of the features the company felt it needed—something that Novell concedes by offering a free upgrade to Version 3.1. This doesn't mean Version 3.0 didn't work or was full of bugs. In fact, for a new

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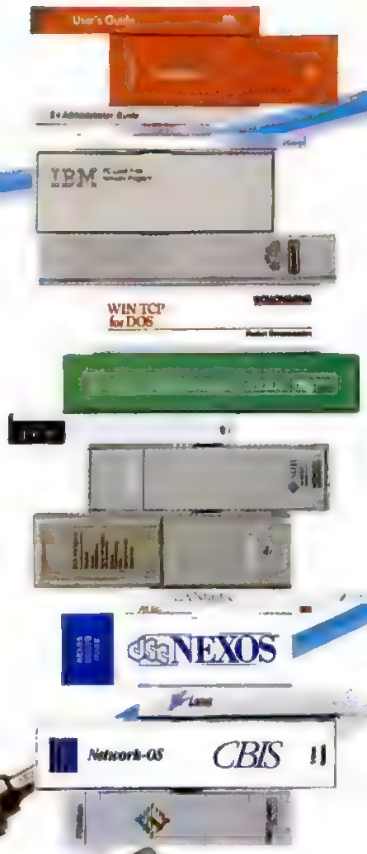

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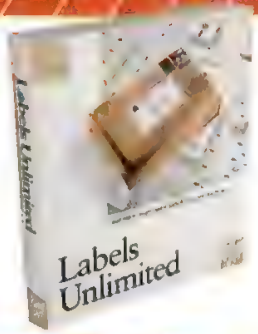

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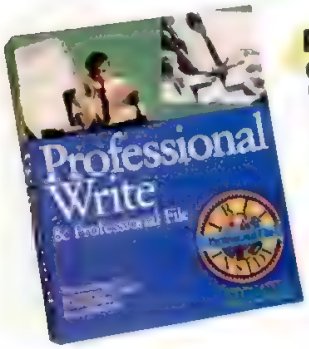

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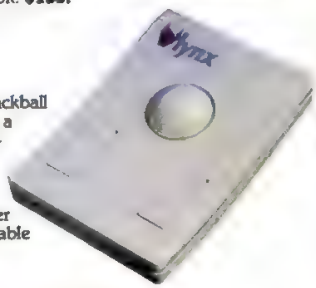

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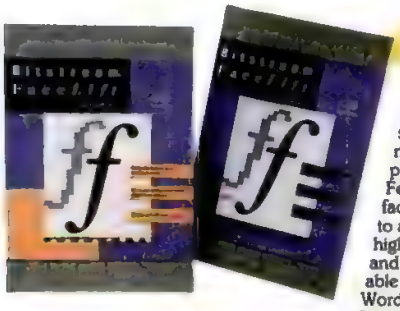

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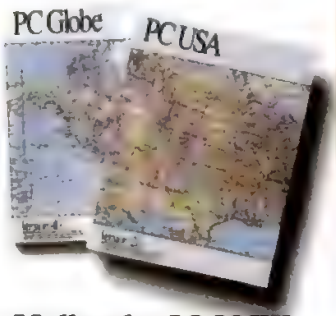

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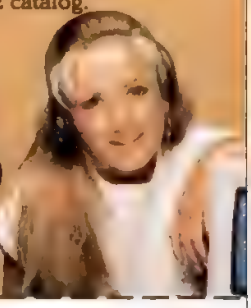

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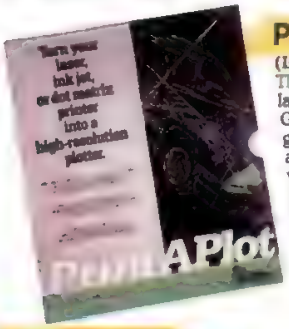

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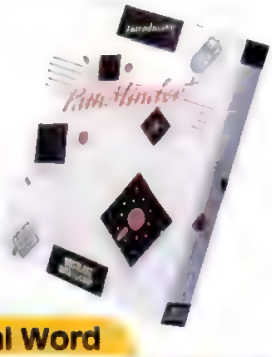

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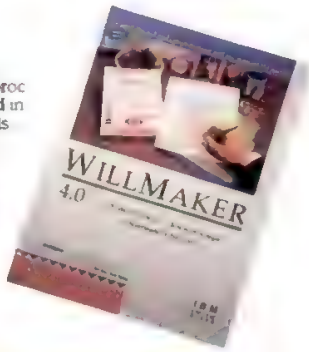

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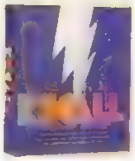
Studyware for the SAT ..... 29.
Teachware
Teacher in a Box Word Perfect 5.1 . 62.
Virgin Mastertronic
Clue ..... 23.
Monopoly ..... 23.
Scrabble ..... 23.
XOR
NFL Challenge ..... 59.



Instant Recall

(Chronologic Corp.) Rated best Personal Information Manager by InfoWorld. Unbeatable for keeping track of deadlines, appointments, tasks, notes, names, addresses and phone numbers. View by topic, date, person or category! Uses only 28K. **$64.**

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★ Windows-compatible products

3-G Graphics
Accents and Borders ..... 74.
Images with Impact (various) ..... Call.
Adobe
Adobe Fonts (various) ..... Call.
★ Adobe Type Manager ..... 55.
★ Illustrator - Windows version ..... 369.
★ Streamline-Windows version ..... 219.
Aldus
PageMaker OS/2 ..... 519.
★ PageMaker 3.01 ..... 495.
Artbeats
Dimensions ..... 57.
ArtRight
★ ArtRight Images Vol. 1 or 2 ..... 79.
ArtRight Images/Animals ..... 79.
ArtRight Images
Borders/Flags/Transportation ..... 79.
ArtRight Images/People ..... 79.
Ashton Tate
Applause II ..... 49.
Draw Applause 1.1 ..... 289.
Master Graphics Presentation ..... 288.
AutoDesk
★ AutoDesk Animator ..... 229.
Avery
Label Pro Dot Matrix ..... 49.
Bitstream
Collections ..... Call.
★ FaceLift for Windows ..... 58.
FaceLift for WordPerfect ..... 58.
Headlines ..... Call.
Bourbakidnc.
Fractool ..... 29.
Brightbill-Roberts
Show Partner F/X 3.5 ..... 224.
Broderbund
New Printshop ..... 35.
New Printshop Companion ..... New.
Printshop Companion ..... 35.
Caere Corporation
★ Omnipage 2.0 386 ..... 595.
Computer Support Corp.
Arts & Letters Graphics Editor ..... 439.
Corel Systems
★ CorelDRAW! 1.2 ..... 315.
Custom Applications
★ Freedom of Press ..... 249.
Digital Research
GEM Desktop Publisher 2.1 ..... 169.
GEM Graph ..... 169.
Dunn Systems
Artclips for Toolbook ..... 99.
Electonic Arts
Deluxe Paint II Enhanced ..... 76.
Deluxe Paint Animation ..... 84.
Fox Software
Foxgraph ..... 174.
Good Software
Arriba ..... 103.
IBM
Storyboard Plus 2.0 ..... 239.
Isogon Corporation
Font Space ..... 64.
Lasergo Inc.
GoScript 3.0 ..... 92.
GoScript Plus 3.0 ..... 236.
Go Styles Volume 1 ..... 127.
Logitech
Catchword ..... 135.
Finesse ..... 99.
Lotus
Freelance Plus 3.0 ..... 319.
Matrix Software Tech.
Layout 2.0 ..... 129.
Metro Imagebase
Metro Imagebase ..... Call.
Micrografx
ClipArt: Anatomy Library ..... 95.
★ Designer 3.01 ..... 479.
★ Charisma ..... 344.
Graph Plus ..... 323.
Xport ..... 279.
MicroMaps
Atlas PC ..... Call.
Micrologic
More Fonts ..... 89.
Microrim
DB Graphics ..... 192.
Microsoft
Chart 3 ..... 239.
★ Powerpoint for Windows ..... 319.
New England Software
Graph-In-The-Box Executive ..... 159.
New Visions Technology
Presentation Task Force ..... 134.
Paul Mace
Grasp 3.1 w/Art Tools ..... 106.
Grasp 3.5 ..... 110.
PC Publishing
Impress ..... 74.
Power Up Software
Express Publisher 2.0 ..... 83.
Software Publishing
Art Gallery ..... 84.
Harvard Graphics 2.3 ..... 319.
Harvard Graphics LAN Pak 1 ..... 1095.
PFS: First Publisher 3.0 ..... 95.
Screenshow Utilities ..... 98.
US Mapmaker ..... 99.
Springboard
The Newsroom Pro 1.0 ..... 23.
Summak Enterprises
Quick Graph ..... 70.
Systat
Sygraph 1.1 ..... 439.
Three D Graphics
Perspective Jr. ..... 74.
Timeworks
Publish-It! 1.2 ..... 132.
Publish-It Lite! ..... 33.
T/Maker
ClickArt Business Cartoons ..... 42.
ClickArt Business Images ..... 42.
ClickArt EPS (various) ..... 80.
Unison World
Avagio ..... 169.
WordPerfect
DrawPerfect ..... 269.
Xerox
Gray F/X ..... 304.
Ventura Pub. Gold Series 3.0 ..... 539.
Xerox Graph 1.0 ..... 195.
Zenographics
Pixie 2.0 ..... 165.
Z-Soft
★ PC Paintbrush IV for Windows ..... 84.
★ PC Paintbrush IV Plus ..... 109.
SoftType ..... 115.

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CAD PRODUCTS

American Small Business Co.
Design CAD 3D 4.0 ..... 143.
AutoDesk
Autosketch 2.0 ..... 95.
Computer Easy
Dream House Professional ..... 47.
Floorplan ..... 26.

WordMunchers & Number Munchers

(MECC) These instructive computer games will motivate your children to learn to read and understand basic arithmetic concepts. Players munch on target vowel sounds or numbers that match a target value and earn points for their successful bites. **$25 ea.**

Digital Research
GEM Draw Plus 2.01 ..... 159.
Foresight Resources
★ Drafix Windows CAD ..... 435.
Generic Software
Basic Home Design ..... 31.
Generic CAD 3D Drafting ..... 179.
Generic CAD 5.0 ..... New.
Generic CAD Level 3 w/ Dot Plot .. 209.
Grolier
Electronic Encyclopedia ..... 219.
Mathsoft
Mathcad 2.5 ..... 293.
Summagraphics
Summasketch II w/ 4 button ..... 399.

BUSINESS

Abacus
★ Becker Tools ..... New.
Above Software
Above Disk 3.0 ..... 59.
Above Mem ..... 41.
Absolute Solutions
★ Computerized Classic Acct. ..... 209.
Access Software
Prompt ..... 74.
Advanced Software
Docucomp (3.5) ..... 109.
Alpha Software
Alpha 4 ..... 299.
Applause Software
The Perfect Addition ..... 29.
The Perfect Addition III ..... 29.
Application Techniques
Pizzaz Plus ..... 67.
asd Software, Inc.
★ Planisoft ..... New.
Ashton Tate
Control Room ..... 72.
dBASE IV 1.1 ..... 479.
dBASE III Plus 1.1 ..... 453.
dBASE IV Developer's Toolkit ..... 830.
dBASE IV LAN Pack ..... 638.
Framework III 1.1 ..... 449.
Multimate 4.0 ..... 291.
Multimate Adv. II PEP ..... 10.
Ask Sam Systems
askSam 4.2 ..... 159.
Atech/M
★ Publisher's Power Pak
for Windows ..... New.
Automated Design Systems
★ Windows Workstation ..... 535.

Impress

(PC Publishing, Inc.) Create printed output from Lotus1-2-3 files that looks like desktop published output. Create, view and print in four typefaces, sizes from 3 to 24 points. Add light background or shades of grey to your spreadsheet and print graphs and spreadsheets together. **$74.**

CIRCLE 225 ON READER SERVICE CARD

Avery
LabelPro ..... 49.
List & Mail Plus ..... 38.
Bell Atlantic Corp.
Thinx ..... 305.
Better Software Technologies
Swith-It ..... 71.
Bloc Publishing
Dan Bricklin's Page ..... 59.
Form Filler 3.0 ..... 84.
Form Tool Gold ..... 56.
Personal Lawyer ..... 37.
Personal Lawyer 2.0 ..... 37.
Pop Drop Plus ..... 56.
Blythe Software
Omnis 5 ..... 499.
Borland International
Eureka 1.0 ..... 109.
Paradox 3.5 ..... 529.
Paradox 386 ..... 569.
Reflex ..... 169.
SuperKey 1.1 ..... 65.
Sqz Plus! ..... 64.

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Brightbill-Roberts
HyperPAD 2.0 ..... 83.
Broderbund
BannerMania ..... 21.
★ Dragnet ..... 82.
MemoryMate 3.01R ..... 38.
★ Prompt ..... 74.
Button Ware
PC File 5 0 ..... 72.
CE Software
Quickmail 2.2 ..... 59.
Quickmail 5-user ..... 189.
Central Point Software
Copy II PC 5.0 ..... 22.
PC Tools Deluxe 6.0 ..... 85.
Checkfree Technologies
Checkfree Express 2.0 ..... 19.
Chronologic Corp.
Instant Recall ..... 64.
Chronos
Who What When 2.0 ..... 172.
Clarion Software
Repom Writer ..... 119.
Compuserve
Compuserve Info Service ..... 21.
Computer Associates
SuperCalc5 1.0 ..... 299.
Compuware
PowerBase 2.3 ..... 169.
Contact Software Int'l
ACT! 2.01 ..... 229.
Core International
CoreFast 2.0 ..... 75.

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Ready Net Add-On Kit ..... 164.
Ready Net Start-Up Kit ..... 324.
Crosstalk Communications
Crosstalk XVI 3.71 ..... 104.
★ Crosstalk for Windows 1.1 ..... 117.
Custom Applications
★ Freedom of Press ..... 249.
Dac Software
Dac Easy Accounting 3.0 ..... 79.
Dac Easy Accounting 4.01 ..... 79.
DacEasy Base ..... 29.
Dac Easy Bonus Pak 4.1 ..... 159.
DacEasy Light ..... 39.
Dac Easy Payroll 4.1 ..... 59.
Lucid 3-D 2.0 ..... 55.
Rolodex Live ..... 29.
Dariana Technology
System Sleuth ..... 83.
★ Win Sleuth ..... 83.
Data Ease International
DataEase 4.2 ..... 476.
Datastorm Tech.
Hot Wire ..... 68.
Procomm Plus 1.1 ..... 59.
Procomm Plus Netwk. Wk. Station . 39.
Procomm Plus Network 1.05 Pak . 345.
Delrina Technologies
PerFORM 2.1 (w/Rebate) ..... 159.
PerFORM Filler 2.0 ..... 75.
PerFORM Filler LAN ..... 332.
★ PerFORM PRO ..... 275.
Delta Technology
Direct Access 5.0 ..... 59.
Extra ..... 54.
Describe Inc.
386 Accelerator Describe ..... 405.
Describe for OS/2 ..... 409.
Digital Composition Syste
dbPublisher Professional ..... 399.
Digital Research
Gem Wordchart ..... 109.
Dolphin Software
Perfect Presentation ..... 89.
Dow Jones & Company
Dow Jones News/Retreival Kit ..... 19.
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Market Analyzer Plus 242

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Market Manager Plus Prof. ..... 269.
Spreadsheet Link ..... 134.
Dynamic Microprocessor Assoc.
pcAnywhere IV ..... 99.
Easysoft
Dos Partner ..... 49.
Emerging Tech.
Menu Magic ..... 30.
Enable Software
Enable 5 Pack Workstation ..... 1215.
Enable BP ..... 119.
Enable/OA ..... 409.
Famware
Family Fortune ..... 39.
Family Reunion ..... 39.
Fifth Generation
Brooklyn Bridge 3.0 ..... 82.
Fastback Plus 2.10 ..... 115.
Mace Utilities 1990 ..... 85.
Fischer
Watchdog ..... 170.
FormalSoft
ProQube 1.03 ..... 59.
FormGen Corp.
FormGen Plus 5.0 ..... 139.
Formworx Corp.
★ Form Publisher for Windows .. 139.
Formworx 2.5 ..... 39.
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Foxbase + 2.1 Runtime Module .. 249.
Foxbase + Dev. Sys. 2.1 ..... 185.
FoxPro ..... 469.
FoxPro LAN ..... 639.
FoxPro Unlimited Runtime ..... 279.
Funk Software
Allways 1.0 ..... 105.
Allways for Symphony ..... 79.
P.D. Queue ..... 54.
Sideways 3.21 ..... 37.
Gazelle Systems
Back It LAN 4.0 ..... 210.
Gibson Research
Spinrite II 1.1 ..... 63.
Great American Software
Money Matters ..... 51.
hDC Computer Corp.
★ FirstApps ..... 49.
★ Windows Express ..... 49.
Hayes
Smartcom III ..... 138.
Helix
Headroom 2.03 ..... 69.
NetRoom ..... New.
IBM
Current ..... 355.
IGC
VM/386 1.22 ..... 145.
VM/386 1.22 Net Pack ..... 81.
Individual Software
101 Macros for dBASE ..... 41.
101 Macros for Lotus ..... 41.
Directory Assistance ..... 33.
Informix
★ Wingz for Windows/OS2 ..... 329.
Inset Systems
HiJaak 2.0 ..... 98.
Insight Development
PrintAPlot ..... 123.
Intel
Net Port ..... 499.
Int'l Security Technology
Virus-Pro 1.5 ..... 42.
Intuit
Quicken 4.0 ..... 35.
Iris Associates
★ 3 for 3 ..... 79.
Lattice, Inc.
Lattice C 6.0 ..... 155.
Lifetree
TotalWord ..... 265.
Logitech
Catchword ..... 135.
Lord Publishing
Ronstadt's Financials ..... 99.
Lotus
Agenda 1.01 ..... 259.
Freelance Plus 3.0 ..... 319.
Freelance Plus 3.01 ..... 319.
Lotus 1-2-3 Rel. 2.2 ..... 339.
Lotus 1-2-3 Rel. 3.1 ..... 399.
Lotus 1-2-3 3.1 ..... 439.
Lotus Works ..... 92.
Magellan 2.0 ..... 109.
Metro ..... 59.
Symphony 2.2 ..... 529.
Magee
AutoMenu ..... 33.
Mathsoft
MathCAD 2.5 ..... 293.
Meca
Checkwrite Plus ..... 29.
Home Lawyer ..... 66.
Managing Your Money 6.0 ..... 122.

Merril & Bryan
InfoSpotter ..... 50.
Turbo EMS 5.0 ..... 49.
Metro Software
LaserTwin All In One 2.09 ..... 112.
LaserTwin for Canon ..... 112.
PC Artifax ..... 69.
Microcom
Carbon Copy Autopilot ..... 59.
Carbon Copy Plus 5.22 ..... 119.
Relay Gold 4.0 ..... 161.
Virex PC ..... 72.
Micro Logic
InfoSelect ..... Call.
More Fonts ..... 89.
Microlytics
Gofer 2. ..... 43.
Wordfinder 4.0 ..... 33.
Microrim
Extended Report Writer 2. ..... 199.
R:Base Compiler ..... 605.
R:Base for DOS 3.0 ..... 469.
Relay Gold 4.0 ..... 161.
Microsoft
Excel for OS/2 2.2 ..... 319.
Excel Node ..... 159.
★ Excel for Windows 2.1c ..... 309.
★ License Pack Excel For Windows ..... 275.
★ License Pack PowerPoint For Windows ..... 275.
★ License Pack Word For Windows ..... 275.
★ Office for Windows ..... New.
★ Productivity Pack ..... New.
★ Project for Windows 1.0 ..... 459.
★ Windows 3.0 ..... 88.
★ Windows Developer's Tool Kit . 309.
Word 5.0 ..... 205.
★ Word for Windows 1.1 ..... 309.
Works 2.0 ..... 95.
Monogram
Dollars & Sense 3.1 ..... 99.
Multisoft
PC-Kwik Power Disk ..... 46.

Check It!

(TouchStone Software Corp.) Check IT! is an information and diagnostic utility that can help you find a problem in your system and even isolate and repair it. It can also give you a complete readout of your system's configuration, as well as run through a series of diagnostics. **$82.**

PC-Kwik Powerpak 1.5 ..... 70.
Super PC-Kwik 3.3 ..... 49.
MySoftware Co.
MyAdvancedMailList ..... 28.
MyCheckbook ..... 14.
MyLabelMaker ..... 14.
NBI, Inc.
Legacy ..... New.
New England Software
Graph In The Box Executive ..... 159.
Nolo Press
For the Record ..... 29.
Willmaker 4.0 ..... 36.
Norton Lambert
Close Up Customer/Terminal ..... 119.
Close Up Support/ASC 3.0 ..... 154.
OCR Systems
Read Write ..... 349.
On-The-Go-Software
Expense-IT! ..... 82.
Owl International
Guide (5.25; 1.2MB) ..... 185.
Owl Guide 3 ..... 379.
Paperback Software
VP-Planner Plus 2.0 ..... 117.
VP-Expert 2.0 ..... 115.
PC Publishing
Impress 2.0 ..... 74.
Peachtree Software
Peachtree Complete III ..... 139.

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Quick Schedule Plus 3.1 ....47.
Top Priority ....58.
Working Hours ....56.
Precision Software
★ Superbase 2 Windows ....164.
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Prime Solutions
Disk Technician Advanced 6.0* ....88.
Primetime Software
Primetime Personal ....68.
Prodigy
Prodigy Start Up Kit ....29.
QMS
★ Ultrascript PC 2.1 ....119.
★ Ultrascript PC Plus 2.1 ....256.
Qualitas
386Max Professional ....75.
Blue MAX (Mem Mgr) for PS/2 ....New.
Quarterdeck Office Sys.
DESQview 2.3 ....69.
DESQview 386 5.1 ....119.
QEMM 50/60 5.1 ....59.
QEMM 386 5.1 ....55.
QRAM ....45.
Reality Technologies
Wealthbuilder 1.1 (by MoneyMag.)135.
WealthStarter ....44.
Reference Software
Grammatik IV 1.0 ....49.
★ Grammatik Windows ....49.
Revolution Software
Cruise Control ....32.
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Ami 1.2 ....New.
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Inbox Plus Mac/PC 100-User ....610.
TOPS 3.0 Network Bundle DOS ...286.
TOPS FlashCard ....148.
SoftKlone
Mirror 111 2.0 ....82.
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PFS: Preface ....44.
Professional Write 2.2 ....159.
Solution Systems
Brief 3.0 for DOS ....159.
Spinnaker Software
BetterWorking Eight-In-One ....35.
The Resume Kit ....29.
Sybiz
Service Industry Accounting ....295.
Symantec
Grandview 2.0 ....196.
Norton Util. Advanced 5.0 ....109.
Norton Commander 3.0 ....95.
Q & A 3.0 ....219.
The Norton Backup 1.0 ....95.

Graph-In-The-Box Executive

(New England Software) Graph-In-The-Box Executive simplifies the task of creating business charts, including text charts and organization charts. It also features nine fonts for text and an attention-getting 3-D effect. **$159.**

Think Tank 2.41 ....129.
TimeLine 4.0 ....459.
Systat
Systat 4.1 ....529.
Timeslips Corp.
PercentEdge 1.0 ....59.
Timeslips III 3.4 ....165.
Timeslips III Network Edit. ....389.
Timeslips Speller ....56.
Toolworks
Lengthwise ....24.
Toolworks Office Manager ....29.
Touchstone
Check It! 2.1 ....82.
Traveling Software
Battery Watch II 2.0 ....29.
Desk-Link 2.21 ....99.
Laplink III ....85.
Unison World
Chain of Command ....85.
Unison Software
Chain of Command ....85.
Vertisoft
Double Disk ....60.
Visionary Software
Synchronicity 2.0 ....36.
West Lake Data
Pathminder Plus ....76.
Westlake Value Pak ....64.

Microref Keyboard Templates

(Microref) Find complete software commands and procedures in seconds. Microref Keyboard Templates are utility tools that will help you use software quickly and productively. Also available separately are Microref Guides, quick reference guides that summarize overly technical manuals. **New.**

Wolfram Research
Mathematica ....575.
WordPerfect Corp.
LetterPerfect ....127.
WordPerfect 5.1 ....249.
WordPerfect 5.1 Ntwk. Bundle ....249.
WordPerfect 5.1 Ntwk. Node ....159.
WordScience
Definitions Plus ....65.
WordStar U.S.A.
WordStar 2000 Plus
Personal Rel.3 ....269.
WordStar 6.0 ....256.
Xerox
Formbase ....324.
XTree Company
XTree Net Adv ....275.
XTree Net Els ....139.
XTree Pro Gold ....69.
Zaron Software
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Zenographics
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TAX SOFTWARE

Chipsoft
TurboTax Personal 1040 ....New.
Turbo Tax Personal 1040 7.0 ....New.
Turbo Tax Pre Series 1120 ....New.
DacSoftware
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Sylvia Porter's Rapid Tax ....New.

Dream House Professional

(Computer Easy) Use Dream House Professional to draw up your own floor plans quickly and easily, and it will automatically calculate square footage and dimensions. Select icons from its library to indicate things such as doors, sinks and toilets and select solid or dotted lines to indicate interior walls, patios and cabinets. **$47.**

Oxxi
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Simon & Schuster
J.K. Lasser Tax Advantage 1990 . New.
Softview
★ MacInTax for Windows ....New.

LANGUAGES

Asymetrix
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Borland International
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Turbo C Prof. ++ ....170.
Turbo Editor Toolbox 4.0 ....65.
Turbo Pascal 5.5 ....98.
Turbo Pascal Prof. 2nd Edition ....164.
Clarion Software
Personal Dev. System ....47.
Professional Dev. System 2.1 ....499.
Command Technology Co.
SPF/PC 2.1 ....146.
Harvard Associates
PC Logo 3.0 ....68.
Microsoft
Basic Prof. Dev. Sys. 7.0 ....319.
C Compiler 6.0 ....310.
Cobol 3.0 ....545.
Macro Assembler 5.1 ....94.
Quickbasic 4.5 ....65.
QuickC 2.5 ....63.
QuickPascal ....65.
Nantucket
Clipper ....492.
Peter Norton
Norton Editor 1.3 ....47.
Solution Systems
Brief 3.0 for OS/2 ....159.
Brief for DOS ....159.
Spinnaker Software
Spinnaker Plus ....285.

CompuServe Electronic Mail code: GO MCW

Adobe Type Manager

(Adobe) ATM allows Windows 3.0 applications to display and print high quality text at any size, automatically. ATM brings scalable PostScript font software to the PC display and non-PostScript printers for the first time. Works with Windows 3.0 and eliminates the need for bitmapped screen and printer fonts. **$55.**

CIRCLE 225 ON READER SERVICE CARD

operating system the product actually contained relatively few bugs, and Novell corrected them immediately—a tribute to the quality of the company's engineering teams.

However, the first release of Novell's *NetWare 386* needed better development tools and a few adjustments before it could realize maximum performance for its file services and better integration of other products.

Novell fine-tuned the already speedy file system, squeezing out a little extra performance for the new release by optimizing many repetitive routines. Mounting volumes—a way of telling *NetWare* that a disk is available for users to access—works three times faster under Version 3.1 than under 3.0.

The new version of *Netware* also does not cache deleted files, and Novell programmers have rewritten the disk drivers so that it takes a maximum of 4 seconds to delete users or groups from the bindery. Formerly, that procedure could take up to 2 minutes.

Novell added support for removable media, making it much easier for vendors to write drivers for CD-ROMs, electro-optical drives, WORM drives, and products like Iomega's Bernoulli box. Some vendors used elaborate workarounds to make their removable products work under 3.0, but 3.1 now includes the needed function calls. 3.1's Monitor *NetWare* Loadable Module includes options for mounting and dismounting volumes, allowing a smooth integration of user access to the mounted volumes.

> Netware holds a potentially large advantage over *LAN Manager* in multiple-OS compatibility.

THE NETWARE ADVANTAGE

NetWare holds a potentially big advantage over *LAN Manager* in multiple-OS compatibility. Novell plans support for Sun Microsystems' NFS and Apple's AFP file systems. Soon users of these computers will be able to store their files on a *NetWare 386* 3.1 server. Although Novell announced this support for Version 3.1, so far it is absent from the released product. And while OS/2's HPFS includes support for long filenames and extended file attributes, Microsoft has not announced any other file system support except that already included for DOS.

NetWare 3.1 already includes many other new features. The server now autoloads specified NLMs, enabling an unattended server to return to its ready state after a power outage. The workstation software also supports expanded and extended memory to allow the workstation more room for DOS applications.

NetWare 386 is designed to help the network administrator succeed in his or her maintenance and troubleshooting tasks. The product's maturity shows in the

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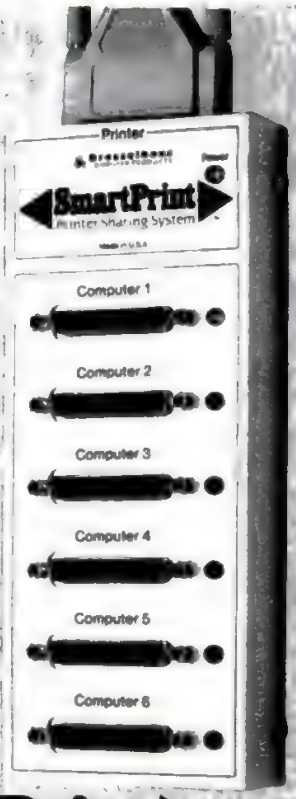

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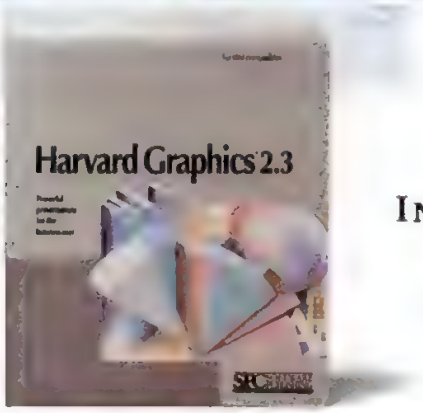

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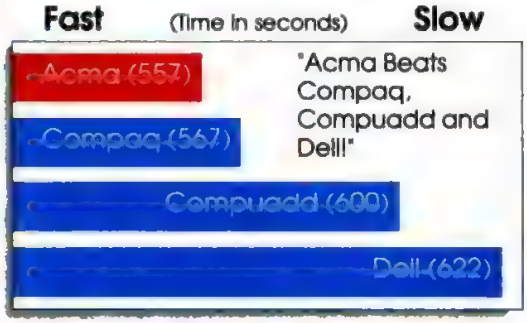

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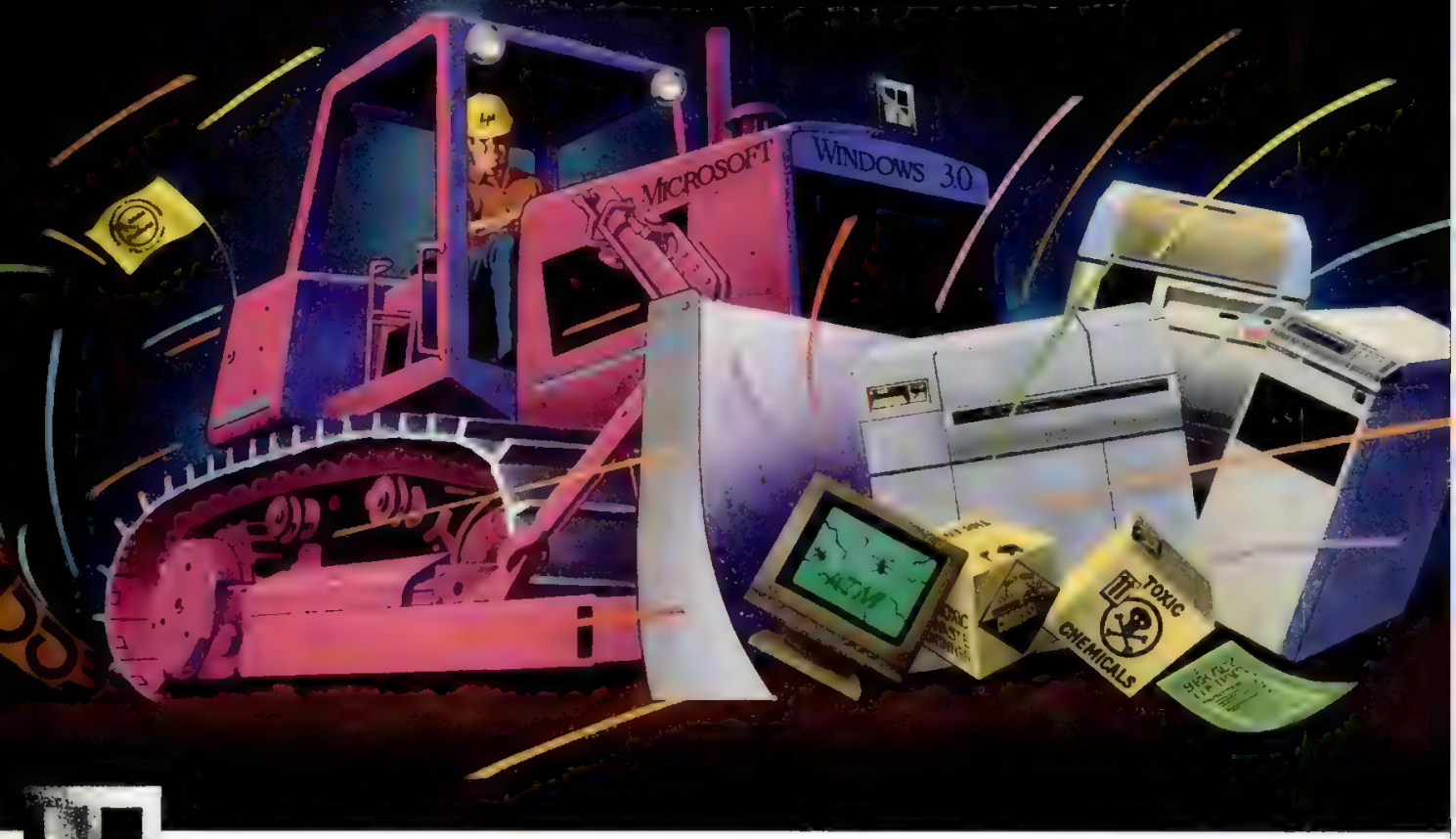

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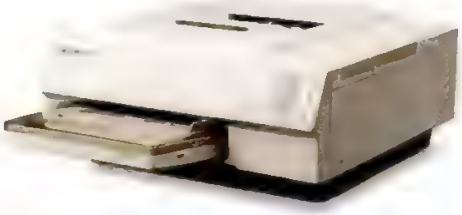

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way it reports error messages. When we left the cable disconnected from the server and tried to start the OS, *NetWare 386* responded, "The network cable is not connected to the computer." *NetWare*

> The remote-console NLM can monitor server information from a workstation—a network manager's dream.

also reported receiving an unusual number of bad packets from one workstation. Upon inspecting the network connection, we found the culprit: a small crack in the T connector.

Novell displays its commitment to supporting and complying with industry standards. In its current version, *NetWare 386* supports ODI (Open Data-Link Interface) workstation drivers, allowing one network card to use multiple protocol stacks simultaneously. In addition, *NetWare 386* supports interprocess communications like Named Pipes, streams, SMB (server message blocks), and sockets. By implementing these standards, *NetWare* provides better interoperability with network applications.

COMPLETE NLM SUPPORT

Version 3.0 offered limited support for *NetWare* Loadable Modules, but with 3.1 NLMs gain complete functionality. Version 3.1 includes Btrieve, remote console, and print services NLMs. Together, these NLMs provide valuable services to *NetWare* users.

The Btrieve NLM is a high-performance key-indexed record manager for developers. As a back-end data management service, it supplies a good foundation for server-based applications and maintains compatibility with the 10,000 existing Btrieve applications.

FACT FILE
EDITOR'S CHOICE

***NetWare 386*, Version 3.1**
Novell Inc., 122 E. 1700 South, Provo, UT 84606; (800) 453-1267, (801) 379-5900.
List Price: $7,995.
Requires: Server: 3MB RAM (6MB recommended), i386- or i486-based processor, supported hard disks, DOS 3.0 or later. Workstation: 640K RAM (EMS 4.0 memory recommended), one floppy disk drive, DOS 2.0 or later.
In Short: The next-generation network operating system from Novell, *NetWare 386*'s simple installation, dynamic self-configuration, and virtually unlimited file system capabilities provide companies with a robust network OS, particularly for server-based applications with NLMs.

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The remote-console NLM allows a system administrator to monitor the server information from a workstation. This feature fulfills a network manager's dream. An administrator can sit at any worksta-

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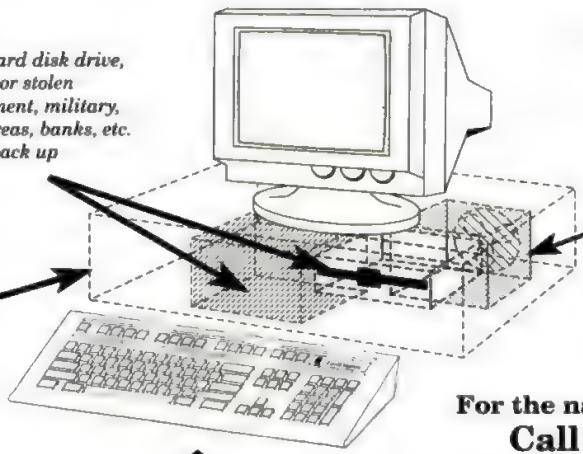

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tion and monitor any server on the network. In addition to monitoring, the administrator's computer acts as if it were the server console, allowing an administrator to load and unload NLMs and completely control the server.

The print services NLM allows a network to spool and queue print jobs for up to eight printers; it also allows authorized users to access and manipulate print jobs. While this NLM performs much better than the older *NetWare* 2.15 software, it runs relatively slow compared with *LAN Manager* 2.0's Print Manager.

At present, *NetWare 386* can boast of many more add-on services than *LAN Manager*. Since *NetWare* has the largest market share, many software vendors have converted the 2.1*x* version of their utility into an NLM for *NetWare 386*. Companies such as Fresh Technology Group, Blue Lance, and Brightwork Development market dozens of add-on products for *NetWare*.

IN THE CLIENT

On the workstation side, *NetWare 386* 3.1 contains many enhancements. OS/2 client stations now include full IPX/SPX, NetBIOS, and Named Pipe support. The introduction of Named Pipes paves the way for applications appearing in 12 to 18 months that will use this powerful peer-to-peer communications architecture (see the sidebar "Named Pipes and Client/Server Computing").

> At present, *Netware 386* can boast of many more add-on services than *LAN Manager*.

NetWare 386's new SHELL software will please DOS users. By supporting expanded and extended memory, *NetWare* frees 34K of conventional memory for applications. Finally, users can unload NetBIOS and the workstation software, freeing memory when they don't need the network.

Integration with *Windows* 3.0 makes it easy for users to attach to file servers and printers without exiting *Windows*. With *Windows*' NETPOPUP program, workstations receive broadcast messages in a window without disrupting any running applications. However, PC LAN Labs continues to receive reports of terminated print jobs and garbled e-mail when running all versions of *NetWare* through the *Windows* drivers. Anyone switching to *Windows* or installing networks must carefully consider the merger of these two technologies.

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Upgrading from 3.0 to 3.1 could not be easier. Simply put System Disk-1 in drive A:, type LOAD A:INSTALL, and 15 minutes later you're finished. *NetWare 386* 3.0 would upgrade only from Version 2.15 servers, but with 3.1 you can upgrade from servers as old as Version 2.0a.

Installing *NetWare 386* is simple. Novell engineers have even found a way

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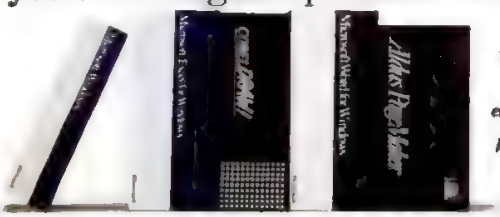

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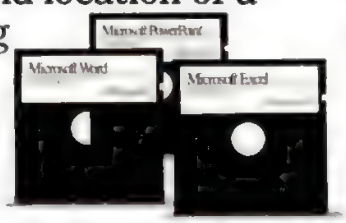

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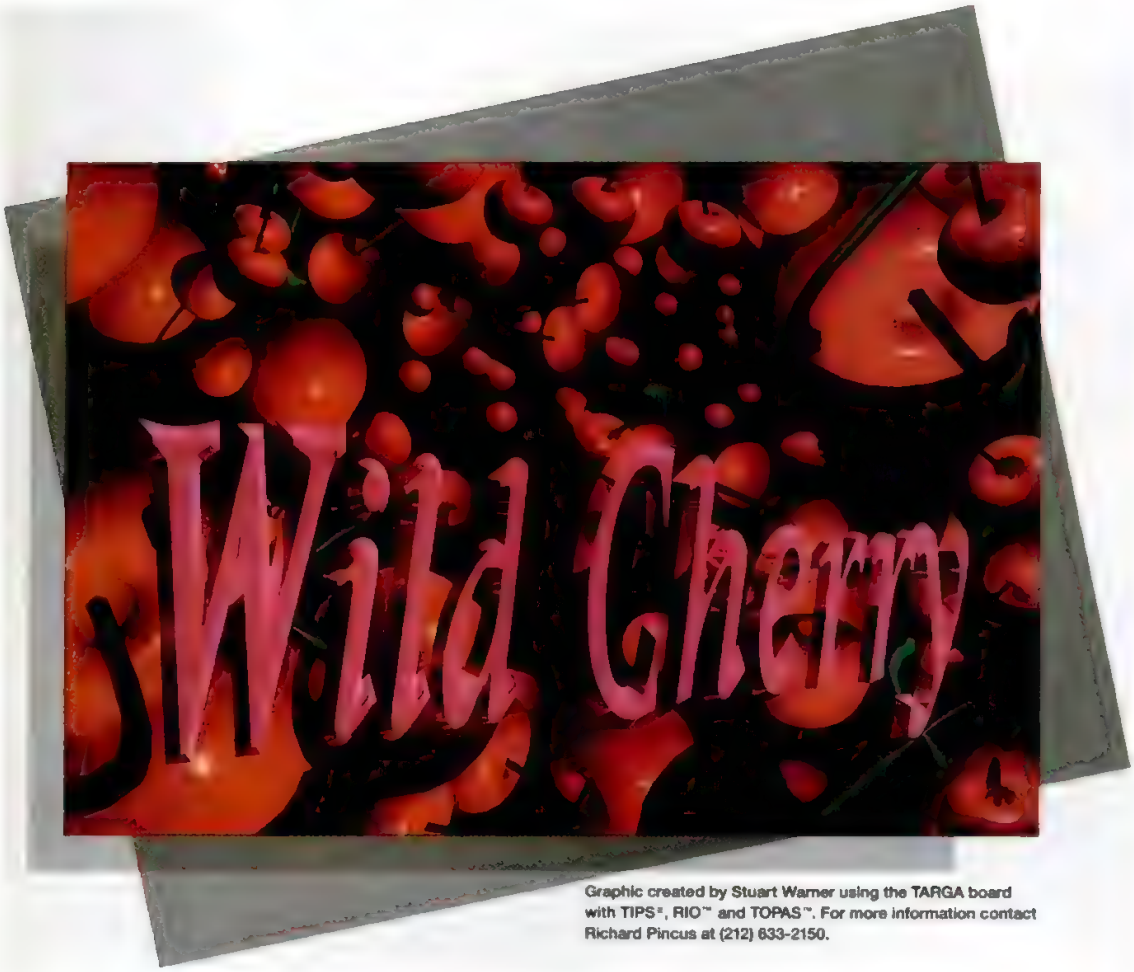

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to avoid the tedious job of formatting the hard disk at installation time. Instead, they format the disk on the fly—saving valuable configuration time. Unlike the original, *NetWare 386* does not require many years of computer expertise to operate. However, understanding and implementing a network requires far more knowledge than it takes to type LOAD A:INSTALL. We recommend using an experienced Novell value-added reseller (VAR) for installation and training.

NetWare 386 boots from a DOS partition (or floppy disk) and then runs the SERVER.EXE program. This program changes to i386 protected mode to access the *NetWare* partition. Since *NetWare 386* cannot boot from the *NetWare* partition, Novell recommends creating a 2MB DOS partition for booting. This loads the network operating system approximately ten times faster than from a floppy. Keep in mind, though, that your server copy of DOS needs to be properly licensed.

Novell supports its software through a network of resellers across the country.

While Novell made installing and setting up *NetWare 386* on the file server much easier than it did in *Advanced NetWare 286*, the tools supplied for generating the workstation software haven't improved. Genning—that is, generating—the shells still requires some experience and patience. Nevertheless, Version 3.1 does add a preferred server option that allows the network administrator to select the server the users boots from, unlike previous versions that automatically selected the first responding server. If you need help with installation or other problems, Novell supports its software through a network of resellers across the country. It makes support and upgrade contracts available to customers, and, in addition, companies such as Gateway Communications furnish in-depth support for their OEM versions of *NetWare*.

TODAY AND TOMORROW

Today *NetWare 386*'s speed, huge storage space, minimum degradation under heavy loads, and easy installation will make networking life a lot more pleasant. In the future, it will serve as a rich environment for the introduction of a new generation of server-based applications.

NetWare 386 reflects Novell's experience designing frontier network operating systems and represents major improvements in LAN technology. However, Novell has yet to deliver all the things it announced for Version 3.1, including support for Sun Microsystems' NFS and Apple's AFP file systems. A powerful, robust network operating system isn't born overnight, and it will take another year or so for *NetWare 386* to expand and mature.

Frank J. Derfler, Jr. *is workgroup systems editor of* PC Magazine. **M. Keith Thompson** *is a network consultant and frequent contributor to* PC Magazine.

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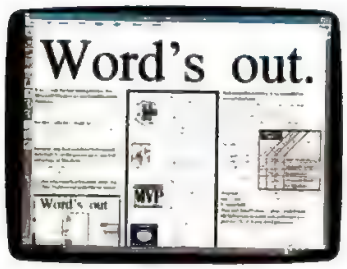

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PC Magazine Editor's Choice

- Of all GUI word processors, Amí Professional has the widest variety of features and is perhaps the most enjoyable to use.

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- A stunning achievement, one that no other PC word processing product— not even Microsoft's estimable Word for Windows — can claim to have reached.

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- Amí Pro's easy to use formatting tools are hard to resist. If your documents typically include graphics, it's your Best Buy.

Infoworld Excellent Value

- Easily handles graphics mixed with text, imports a host of text and graphics formats effortlessly, and does other office chores such as mail merge with ease and power.

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Rating	Overall Evaluation	Overall Power	Program Name
★★★	7.9	6.9	Amí Professional
★★★	7.7	7.7	Microsoft Word
★★★	7.6	8.1	Word Perfect
★★★	7.2	6.7	Microsoft Word for Windows

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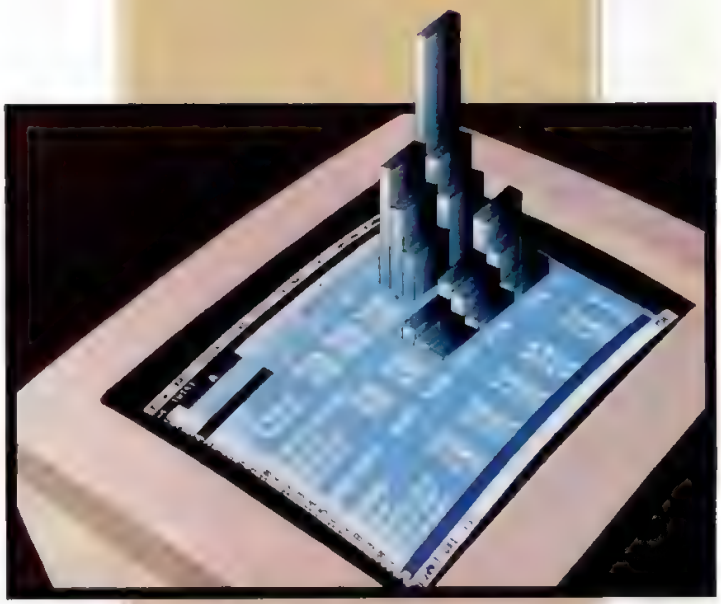
Who Needs a Graphics Package, Anyway?



With spreadsheets sporting better and better graphics, do you really need a presentation graphics program? Our inspection of the graphics capabilities of six leading spreadsheets shows just how far they've come—and where they stop short.

by Craig Stinson

For many users, a spreadsheet is the only graphics package they'll ever own. Spreadsheet graphics were originally intended as analytic aids, producing quick-and-dirty graphs to reveal trends and hidden relationships, while the job of producing presentation-quality charts was left to dedicated graphics packages such as *Harvard Graphics* and *Lotus Freelance Plus*. But today's spreadsheets have cleaned up their visual act so much that to describe a spreadsheet's charting capability merely as "analytic" is now just a polite way of calling it ugly.

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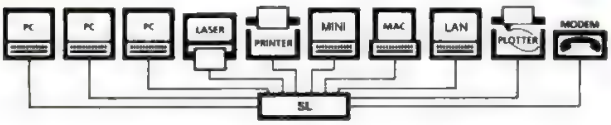

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Where the original version of *Lotus 1-2-3* offered just five elementary chart types, most spreadsheets today produce a full range of business charts, including horizontal bar charts, combination line and bar charts, high-low-open-close charts for tracking stock quotes, and area charts. Some even offer pie-bars (in which bar charts show each data point's percentage of the series total), three-dimensional bars and pies, or proportionally sized sets of pie charts. For the technically minded, logarithmic scaling and multiple *y*-axes are now commonplace features, though regression-based curve fitting, automated error bars, and the ability to graph mathematical functions are still the province of technical charting programs.

Most spreadsheets now offer an impressive array of customizing options that give you a great deal of freedom to shape the elements of a chart—its titles, legends, axes, fill patterns or color—to your own tastes. In almost all cases, you can use a variety of high-quality scalable typefaces for both labels and floating text, and you can add arrows to emphasize points of particular interest with equal ease. Some spreadsheets even let you spiff up your graphs with freehand drawings and clip art. Such abilities make it easy to produce attractive graphs for reports or presentations directly from your spreadsheet.

So the question naturally arises: Is there still a place for programs that used to own the presentation end of the spectrum? What, if anything, can presentation graphics software do that your spreadsheet can't? The short answer depends on what you do. The long answer, we hope, will emerge from this article.

NECK AND NECK

We last reviewed spreadsheets in "Software Heavyweights Take on 1-2-3" (*PC Magazine*, April 24, 1990), but graphics were only one aspect of that evaluation. To give you a more close-up view of the subject, we choose in this article to look at six major spreadsheet packages with an eye to their charting and graphics annotation capabilities. The contenders include our most recent Editor's Choice products, Borland's *Quattro Pro* and *Microsoft Excel*, plus the three current products from Lotus (*1-2-3* Release 2.2, *1-2-3* Release 3.1, and *1-2-3/G* for Presentation Manager), the overwhelmingly dominant vendor in the field. We also chose to include *Wingz*, a *Windows*-based newcomer to the PC that has established a reputation for charting prowess in the graphics-conscious Macintosh marketplace.

As you can see from our features table, which compares the charting and annotation capabilities of these spreadsheets with those of market-leading presentation packages *Harvard Graphics* and *Lotus Freelance Plus*, most of the spreadsheets in our review give up nothing in raw capability. All but *1-2-3* Release 2.2 are just as rich in numeric chart types as their dedicated competitors, and some even stretch to accommodate word charts and other text-only images, though they don't have the timesaving text-entry features that distinguish a true presentation graphics program.

You'll find little difference in the overall quality of the charts as well. Though you'd expect manipulation options to be richer in graphics packages, that's not always true—especially for graphically based spreadsheets, which can offer point-and-click access to just about any element you want. Most of the spreadsheets we review come with a good range of high-quality scalable fonts, and you can usually get additional fonts from Bitstream. Some even offer freehand drawing tools and clip-art embellishments for your charts. Your spreadsheet may not be the right tool for the most demanding of

EDITOR'S CHOICE

- **Microsoft Excel**
- **Quattro Pro**

When all is said and done, the best spreadsheets for graphics are the best ones for everything else—our previous Editors' Choice winners *Microsoft Excel* and *Quattro Pro*.

If ease of use and overall intelligence are most important to you—and you have the horsepower to accommodate it—*Microsoft Excel* should be your choice. Its well-designed Gallery menu gives you immediate point-and-click access to 44 different types of charts in six basic categories. And if you don't get exactly what you want with a Gallery command, customization options are easy to set simply by double-clicking the elements you want to change, and by filling out simple, visually oriented dialog boxes. Its font support and annotation capabilities, while somewhat limited, are easy to use, and its output is plenty good enough for most business purposes.

Quattro Pro's bulky menu tree makes it considerably less easy to use for graphics than *Excel*. But the beauty of its graphs and the many options you have for customizing them makes it worth the trouble if you're demanding about quality. *Quattro Pro* provides a full set of charting options, drawing tools, a wealth of high-quality fonts, the ability to print graphs embedded in worksheets, and even a way to produce simple screen-show presentations—all in a package that works well under DOS on ordinary PCs. And *Quattro Pro* 2.0 will improve its graphics even further, adding a full range of three-dimensional chart options and the ability to import CGM clip art directly.

Though the various products from market leader Lotus have greatly improved their graphics capabilities, they still don't measure up to the best in that area. With its recent enhancements, *1-2-3*, Release 3.1, comes closest to the ideal: It produces good-looking business charts, and its Wysiwyg add-in, while less easy to use than its competitors, matches most of their capabilities. *1-2-3/G* produces gorgeous graphs, but its prowess is tempered severely by its dreadful graphics performance, while *1-2-3* Release 2.2—*Allways* notwithstanding—has simply been left behind.

An honorable mention goes to *Wingz* for its fine three-dimensional charts and technical graphing options. Though eccentricities of design (notably, the inability to create a graph without placing it in a worksheet) and a few unresolved bugs make it impossible to recommend as an Editor's Choice at this point, it's an innovative product with a potentially bright future.

PCs beat Macs for Illustration

REPORT CARD

AUGUST 20, 1990

INFO WORLD

Illustration Software

	(InfoWorld weighting)	(Your weighting)	PC: Adobe Illustrator Version 1.0	PC: Arts & Letters Graphics Editor Version 3.0	PC: Corel Draw Version 1.2.1	PC: Micrografx Designer Version 3.0.1	MACINTOSH: Adobe Illustrator Version 1.9.5	MACINTOSH: Aldus Freehand Version 2.0.2	MACINTOSH: CA-Cricket Draw Version 1.1.1	MACINTOSH: Canvas Version 2.1
Price			$495	$695	$595	$695	$495	$495	$295	$299
Performance										
Drawing/editing	(150)	( )	Good	Very Good	Very Good	Very Good	Very Good	Very Good	Satisfactory	Good
Tracing	(50)	( )	Very Good	Very Good	Very Good	Excellent	Very Good	Satisfactory	Poor	Good
Import/export	(50)	( )	Satisfactory	Satisfactory	Very Good	Very Good	Good	Good	Satisfactory	Very Good
Speed	(50)	( )	Satisfactory	Very Good	Excellent	Good	Excellent	Satisfactory	Good	Good
Output quality	(100)	( )	Good	Good	Excellent	Very Good	Excellent	Very Good	Satisfactory	Satisfactory
Documentation	(100)	( )	Very Good	Good	Very Good	Excellent	Very Good	Good	Satisfactory	Satisfactory
Ease of learning	(100)	( )	Very Good	Good	Excellent	Very Good	Satisfactory	Good	Very Good	Good
Ease of use	(125)	( )	Satisfactory	Very Good	Very Good	Very Good	Satisfactory	Very Good	Satisfactory	Very Good
Error handling	(75)	( )	Good	Poor	Good	Good	Good	Very Good	Good	Very Good
Support										
Support policies	(50)	( )	Satisfactory	Good	Good	Very Good	Satisfactory	Satisfactory	Satisfactory	Good
Technical support	(50)	( )	Satisfactory	Very Good	Very Good	Very Good	Good	Good	Very Good	Very Good
Value	(100)	( )	Satisfactory	Good	Excellent	Very Good	Very Good	Very Good	Satisfactory	Very Good
Final scores			**6.0**	**6.4**	**8.2**	**7.7**	**6.9**	**6.8**	**5.4**	**6.5**
Use your own weightings to calculate your score										

GUIDE TO REPORT CARD SCORES

InfoWorld reviews only finished production versions of products, never beta test versions.

Products receive ratings ranging from unacceptable to excellent in various categories. Scores are derived by multiplying the weighting (in parentheses) of each criterion by its rating, where:

Excellent = 1.0 — Outstanding in all areas
Very Good = 0.75 — Meets all essential criteria and offers significant advantages
Good = 0.625 — Meets essential criteria and includes some special features
Satisfactory = 0.5 — Meets essential criteria
Poor = 0.25 — Falls short in essential areas
Unacceptable or N/A = 0.0 — Fails to meet minimum standards or lacks this feature

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formal presentations, but the charts it produces will be plenty good enough for the vast majority of your business reports and presentations.

CONVENIENCE PAYS

Indeed, since in many cases your spreadsheet will be the source of your data anyway, the ability to create a chart straight from the worksheet is a great advantage because it avoids a file-import step. Having data and charting in one place also makes it much easier to generate updated charts as your data changes—something that a graphics program can do only if it can link directly to worksheet files (see the sidebar "Charting in Bulk").

Your spreadsheet is better for creating graphs that integrate information from a variety of different sources without bringing it all together into a single data sheet. *Quattro Pro, Excel, 1-2-3* Release 3.1, and *1-2-3/G*, for instance, all let you create charts that draw data from two or more separate worksheets; to plot a data series not stored on the current worksheet, you can simply point to it. And *1-2-3* Release 3.1 and *1-2-3/G*'s three-dimensional worksheets give you a cross-sectional charting capability. On identically structured pages, you can easily specify data ranges that bore through the third dimension, letting you compare sales or other common items across a whole group of divisions, time periods, or product lines.

CHARTS IN CONTEXT

An important use for graphics software is the preparation of annotated charts for use in reports. Customarily, one does this by exporting the finished charts and worksheets into files on disk so that they can be imported into word-processed or desktop-published documents. But the publishing add-ins included in *1-2-3* Release 2.2 and 3.1 make it possible for you to implant graphs directly in your worksheets. *Quattro Pro* is similarly capable, and *Wingz* goes even further by letting you place word-wrapped text as well as live graphs on the worksheet.

Excel cannot mingle graphs with worksheet text, but its underlying graphical environment makes it a good tool for creating compound documents. You can easily paste graphs into a suitable *Windows* word processor through the clipboard, and *Excel's* DDE support lets you hot-link graphs so that they're updated automatically when they change. The same applies to *1-2-3/G* and its Presentation Manager environment, which will share its charting module with the upcoming *Freelance for OS/2*, though right now there are fewer applications that work with it than with *Windows*.

WHERE THE BUCK STOPS

Despite their graphics prowess, none of these spreadsheet programs is likely to put presentation software on the endangered species list. True, several of them let you create word charts and freehand drawings. *Quattro Pro* even comes with a built-in slide sequencer, and a soon-to-be-released new version of the same program will let you create "hot buttons" to support branching on-screen presentations. But most users who prepare presentations regularly will still find a need for a dedicated presentation package.

In the first place, there's a lot more to creating a presentation than just stringing together a series of graphics images. Even if you don't need high-quality slide or transparency output, a professional appearance requires consistency. And this is just what presentation graphics software is designed to help you achieve, through the use of common backgrounds, slide templates, text style sheets, and coordinated color palettes.

Second, since most of the slides or overheads in any presentation are word charts, the timesaving text-entry features that presentation packages offer (from automated indenting and bulleting to full outlining) can save you a very meaningful

OUR CONTRIBUTORS

Harry Geist is a technical support manager for marketing operations at *The Equitable* in New York City.

Ronni Geist is the president of *Geist-Writers, Ltd.*, a Nyack, New York–based company specializing in editorial and desktop publishing services.

Rock Miller is an associate editor of *PC Magazine*, responsible for graphics coverage.

Craig Stinson is a contributing editor of *PC Magazine* and the author of the Spreadsheets column in the Productivity section of the magazine.

SPREADSHEET GRAPHICS: SUITABILITY TO TASK

The graphics needs of business users differ from those of technical and scientific users. Use our suitability-to-task scores, which are informed subjective ratings for various tasks, to help you decide which package is right for you. Compare them with the product reviews and the features table for a complete picture of what the product offers.

THE TASKS

The charting and annotation functions of each spreadsheet are rated according to their overall usefulness in two areas.

Business charting is an evaluation of the quality and breadth of the standard business-charting options, as well as the ease with which you can dress up your charts with text, arrows, clip art, and other annotations. The strength of a program's word-charting options is also a factor in the score.

Technical charting evaluates the spreadsheet's support for graphics options of particular interest to technical users: logarithmic scaling, multiple *y*-axes, and curve fitting, as well as the availability of specific types of technical charts such as polar graphs and histograms. The ability to plot a large number of data points is also important. In most spreadsheets, this is limited only by the amount of RAM available in your machine.

THE RATINGS

0 = poor
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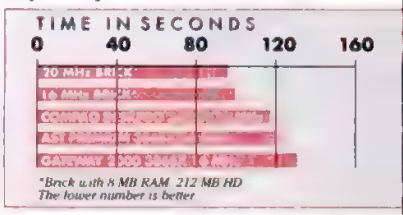

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— PC MAGAZINE, Sept. 1990

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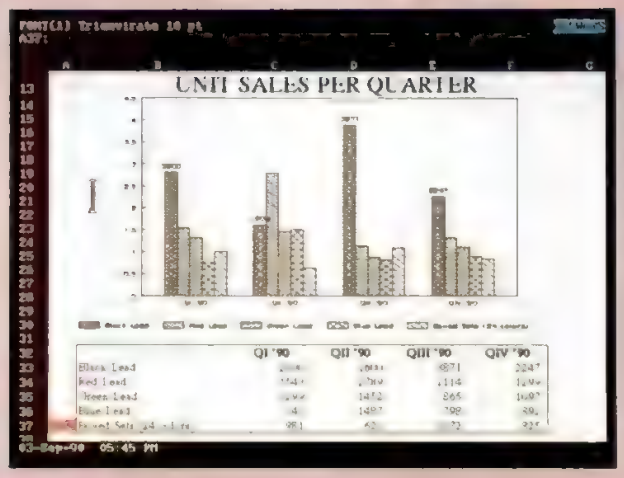
amount of work. No spreadsheet can come close to the integrated environment that such presentation programs as *Microsoft PowerPoint* or Computer Associates' *Cricket Presents* offer.

Still, for a wide variety of everyday uses, from monthly reports to quick overheads, spreadsheet programs fulfill their purposes well. Especially as presentation packages focus more on the management of entire presentations and high-quality output, it's worthwhile to remember that your spreadsheet can offer an inexpensive and simple solution for such bread-and-butter tasks.



The *Allways* add-in included with *Lotus 1-2-3*, Release 2.2 lets you print graphs alongside worksheet text, but doesn't supply much in the way of annotation capabilities.

Lotus 1-2-3, Release 2.2

All reviews by Craig Stinson

The ability to generate graphs from spreadsheet data is one of the features that helped *Lotus 1-2-3* to knock *VisiCalc* out of the box way back when. That the graphs themselves were a little crude and that you had to invoke a separate program to print them were inconsequential matters in 1983. Just to see those lines and bars on-screen was remarkable.

What's remarkable today is how little the graphics capabilities of *1-2-3* have changed. Release 2.2, the current incarnation of "1-2-3 Classic," adds little beyond cosmetic changes to its predecessors. And while Lotus has had the good sense to bundle Funk Software's *Allways* with Release 2.2, this spreadsheet publishing add-in doesn't add any charting capabilities to *1-2-3*'s own, though it does make printing graphs a lot easier.

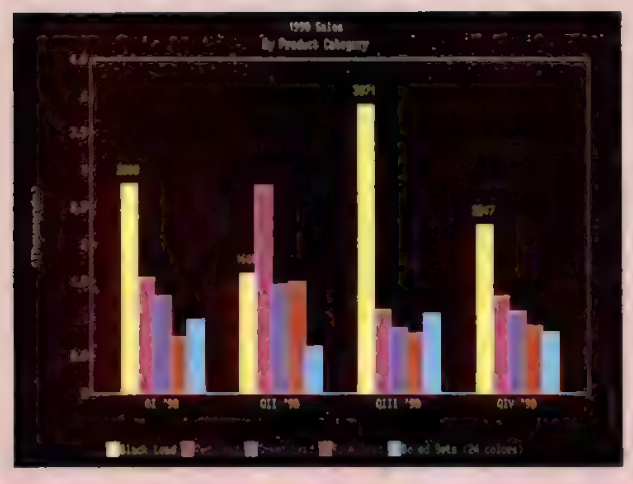
DOWN TO BASICS

Release 2.2 generates just five types of charts: line, vertical bar, stacked vertical bar, pie, and *x,y* (or scatter) charts. It's missing such modern-day basics as area charts, horizontal bar charts, high-low-open-close, and line-over-bar combination charts, though these things can be supplied through extra-cost add-ins (see the sidebar "Supplementing 1-2-3"). You can override the default *y*-axis scaling, but you can't use logarithmic scales or secondary *y*-axes, making it almost useless for technical charting.

Customization options are equally skimpy. You can add titles to graphs and axes, display a legend (at the bottom of the graph only), and attach labels to data points. But you can't add arrows or floating text, and choosing colors or patterns for pie graphs is still a monstrous matter of putting numbers into an artificial data range on the worksheet. (Want to explode a segment? Just add 100 to its format number!) And while Lotus's color choices are attractive, they aren't mapped to distinguishable patterns for black-and-white printing. To get a decent printout on a laser printer, you must select the black-and-white option manually.

With Release 2.2, bar charts no longer butt up against the *y* axes, and *x*-axis labels are now automatically staggered, letting

you use bulky category labels such as month names without making unreadable spaghetti of your axis labels. But in all other visual respects, *1-2-3* Release 2.2's graphs are primitive.



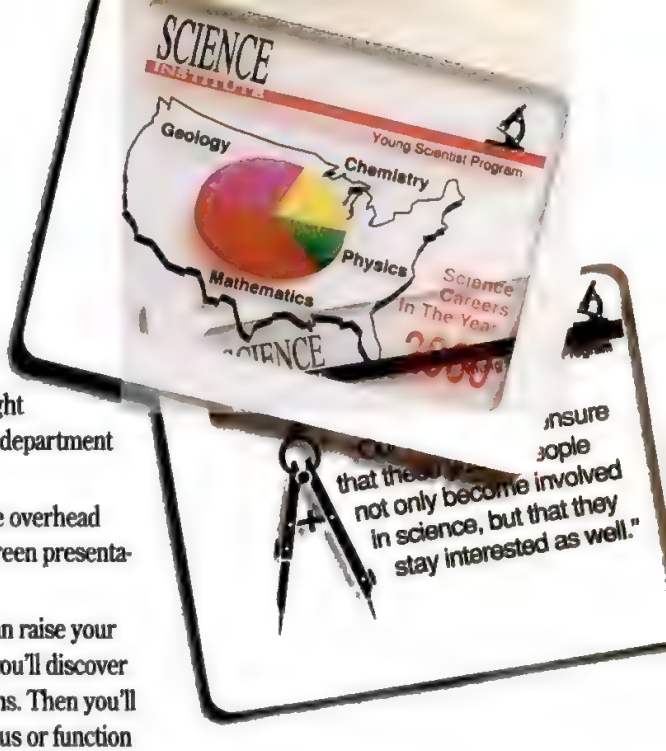
While *Lotus 1-2-3*, Release 2.2's graphs are adequate for analytic purposes, they lack the pizzazz and depth of options offered by competitors.

PRIMITIVE PRINTING

For printing graphs, *1-2-3* Release 2.2 itself still offers only PrintGraph, an archaic utility that prints graphs only after you've frozen them into .PIC files. Changing a graph after seeing it on paper requires you to return to *1-2-3*, make your alterations, resave the .PIC file, go back to PrintGraph, and try again.

Allways, however, helps a lot in this area. It lets you print graphs alongside worksheet text: You just name your graph, stake out a rectangular worksheet range, and drop it in. *Allways* also lets you box your graphs and gives you WYSIWYG

Now, helping them grasp your message...



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FACT FILE

Lotus 1-2-3, **Release 2.2**
Lotus Development Corp., 55 Cambridge Pkwy., Cambridge, MA 02142; (617) 577-8500.
List Price: $495.
Requires: IBM XT, AT, or compatible; 512K RAM; DOS 2.0 or later.
In Short: Though it's still adequate as a spreadsheet, *Lotus 1-2-3*, Release 2.2's graphics hardly shine. Lack of some basic charts and the inability to annotate your results directly without extra-cost add-ins make it not the best choice for the graphics-minded.

CIRCLE **420** ON READER SERVICE CARD

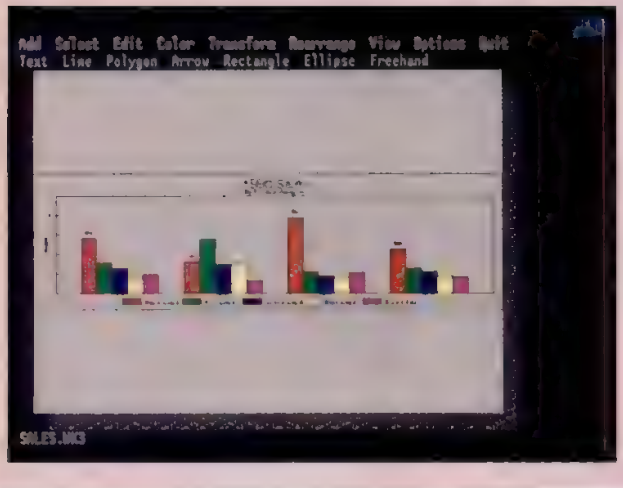
control over their size and aspect ratio. Graphs in *Allways* are transparent, so with a minimal effort you can manage some additional formatting and text-annotation tricks—for instance, you can lay a graph over a carefully positioned worksheet label to add a source footnote or an exclamatory comment. If you're patient, you can even box or shade these annotations for a more professional look.

All this is pretty kludgy, though. Getting a box to fit neatly around a label or title is likely to require column-width adjustment (since *Allways* measures its boxes by the column, not the column's contents). And while text assigned via the Graph commands in *1-2-3* can use only one set of fonts (the PrintGraph set, which *Allways* supports), text that peeks through from the underlying worksheet has a whole different set of fonts to work with (*Allways'* own soft-font set, plus your printer's internal typefaces). Finally, *Allways*, like PrintGraph, prints .PIC files only. Though it's easier to use than PrintGraph, it's still no way to get production graphics work done.

NOT THE BEST CHOICE

A better tool is available in *Impress*, a competitive add-in from PC Publishing that is the foundation of *1-2-3* Release 3.1's much better graphics capabilities. Though it costs $149.95, the Release 2.2 version of *Impress* supports a mouse, lets you annotate your graphs directly using drawing tools and Bitstream soft fonts, and imports CGM files as well as .PIC files into your graphs and worksheets. If you're wedded to *1-2-3* but serious about graphics, you may find it worthwhile to spend the extra money for the improved results it offers.

Still, the bottom line is that graphs in Release 2.2 are good mainly for analysis, and fairly basic analysis at that. If you want publication-quality charts from your spreadsheet, you'll be better off with one of 2.2's competitors.

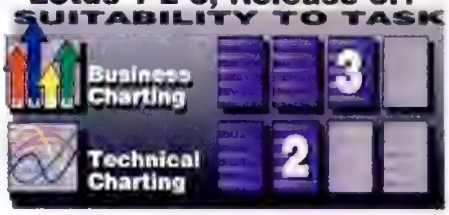


***1-2-3*, Release 3.1's WYSIWYG add-in lets you use scalable fonts in your charts and print them alongside worksheet data. Its editing screen lets you add arrows, free-form text, and other annotations.**

Lotus 1-2-3, Release 3.1

From the standpoint of graphics, the one significant improvement that Lotus's new *1-2-3* Release 3.1 offers over Release 3.0 is its incorporation of PC Publishing's *Impress* add-in (which it calls Wysiwyg). Wysiwyg does for Release 3.1 what *Allways* does for Release 2.2—only better. It lets you display and print live graphs on your worksheets, gives you drawing and text tools to help you upgrade the overall appearance of your graphs, and allows you to import clip art in CGM format.

Lotus 1-2-3, Release 3.1
SUITABILITY TO TASK



Though Wysiwyg is far more versatile than *Allways*, it's still inescapably an add-in. As a result, you have to learn two different, fairly complex menu trees to take advantage of *1-2-3* Release 3.1's full capabilities. To create, name, and save a graph as a .PIC or CGM file, for instance, you must use the Lotus menu tree. But to implant the same graph on the worksheet, add arrows or shapes to it, or adorn it with a clip-art image, you must switch to Wysiwyg commands, accessed with :G instead of /G.

In certain areas, *1-2-3* and Wysiwyg overlap functionally. Both allow you to add text, for example, and both include an extensive set of printing commands. But only certain kinds of text can be added via *1-2-3*, while only *1-2-3* can print to a file. The F10 key displays the current graph from anywhere in the *1-2-3* menu tree, but it is completely nonfunctional on the Wysiwyg menus. Only Wysiwyg offers print preview, and—well, you get the idea. While the division of labor is mostly logical, it makes the system feel exactly like what it is: a patchwork.

GRAPHIC IMPROVEMENTS

The underlying charting module, unchanged from Release 3.0, is a big im-

FACT FILE

Lotus 1-2-3, **Release 3.1**
Lotus Development Corp., 55 Cambridge Pkwy., Cambridge, MA 02142; (617) 577-8500.
List Price: $595.
Requires: IBM AT or compatible, 1MB RAM, hard disk, DOS 3.0 or later.
In Short: *1-2-3*, Release 3.1 produces nice-looking business charts, and the inclusion of scalable font support and worksheet publishing capabilities brings it up to snuff in the graphics department. But graphics capabilities come in the form of an add-in, which makes them somewhat clumsy to use.

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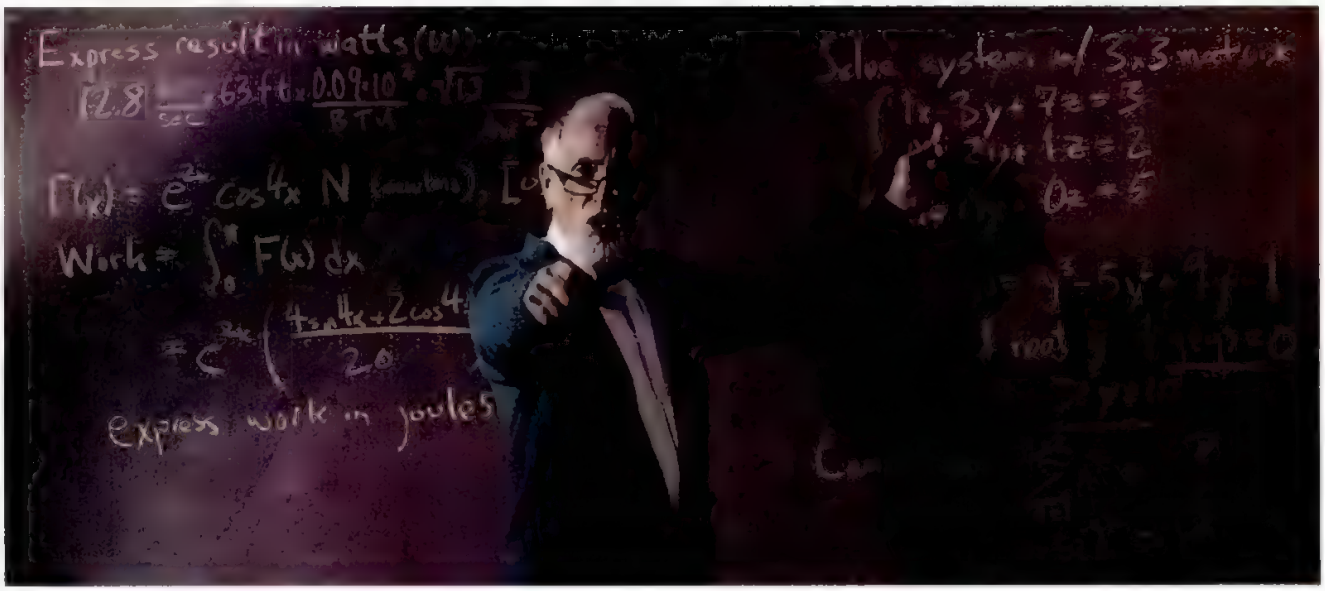

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PC MAGAZINE EDITOR'S CHOICE
March 14, 1989 issue. Best of '88 Best of '87

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U.K.: Adept Scientific 0462-480055; France: ISECEGOS 1-46092768; Germany: Softline 07802-4036; Japan: CRC 03-665-9762; Finland: Zenex Oy 90-692-7677; Italy: Channel 02-4229441. PSE #2

CIRCLE 154 ON READER SERVICE CARD

1-2-3, Release 3.1 offers a broader range of more attractive graphs than its smaller cousin. This horizontal bar graph displays the value scale at the top of the graph.

provement over Release 2.2's. Its repertoire includes line, bar, area, scatter, high-low-close-open, pie, and combination line/bar charts. All but the pies can be drawn vertically or horizontally; in addition, stacked and 100 percent options are available for the line types as well as the bars. The high-low-open-close chart can easily be laid over a bar graph to display transaction volumes: You just put the bars in the E data range, and *1-2-3* automatically plots them against a second *y*-axis.

Its customization options are richer than Release 2.2's as well. It supports up to eight high-quality fonts for label and title text. Your graph can use up to 14 colors or hatching patterns, and you now have the option of using different colors or patterns for different points in the same

SUPPLEMENTING 1-2-3

by Rock Miller

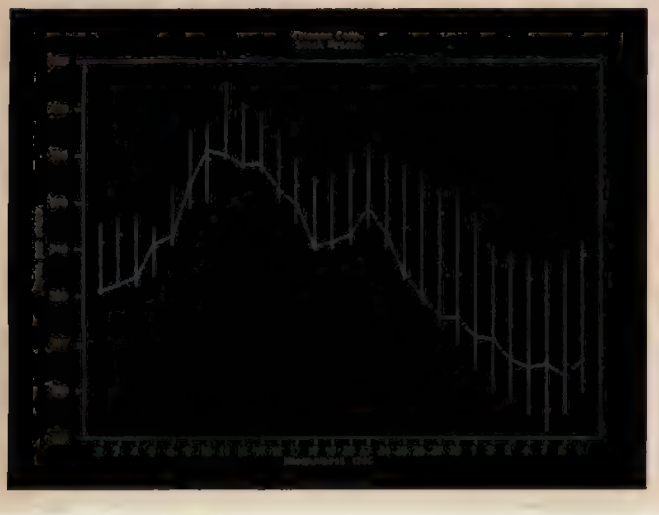
Allways and *Impress* may do a good job of tarting up good old *1-2-3*'s output, but neither adds anything to its charting capabilities. Of course, most presentation graphics packages import .WK1 files directly, but if you'd rather avoid the complexity (and cost) of such programs, check out Intex Solutions' line of graphics add-ins for *1-2-3*, Release 2. These add-ins, *2D Graphics* and *3D Graphics* (each $145), add both breadth and strength to your graphics capabilities without forcing you to leave the *1-2-3* environment.

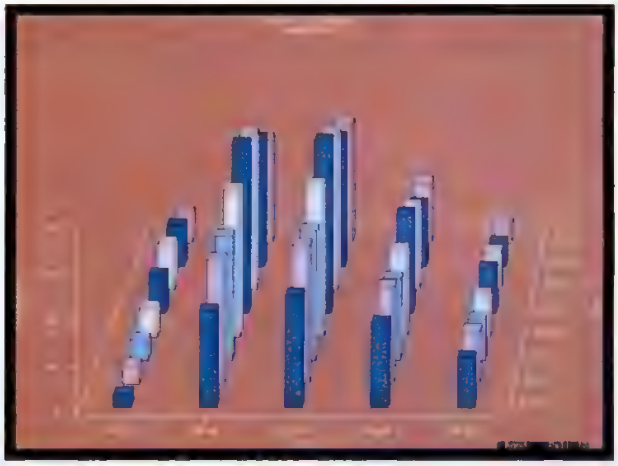
As add-ins, both packages are fairly simple to install, though the instructions given in the manuals aren't as clear as they might be. Once you've loaded one into memory, press the appropriate hotkey and you get a menu of options that looks very similar to *1-2-3*'s own. You can save named graphs and export files in black-and-white or color .PIC format, just as you would in *1-2-3*. You can even use Lotus macros to automate your graphing procedures.

ESSENTIAL FEATURES

2D Graphics is the most broadly useful of the two. It adds several essential chart types, notably stacked area charts (inexplicably called "filled-line graphs") and hi-lo-open-close charts used for tracking stock quotes. Technical users can take advantage of its polar charts and bubble charts (scatter charts in which the data values are represented by circles whose radius is proportional to the data value in a third range), as well as its dual *y*-axis support and logarithmic scales. And users of all kinds will appreciate the ability to chart up to 12 data ranges instead of only 6.

2D Graphics' ability to plot any selected range as a line makes it quite adept at so-called "combination" charts. You can add multiple lines to a bar chart, and you can also add lines to





2D Graphics (left) from Intex Solutions adds more chart types (such as this hi-lo-open-close chart) to *1-2-3* Release 2 and offers a range of scaling and combination-chart options into the bargain. *3D Graphics* (above) adds true 3-D bar charts, as well as surface plots.

series. Colors and patterns can even be assigned conditionally through @IF formulas on the worksheet. Unfortunately, the menu tree provides only cryptic numbers for the color, font, and hatching options. To learn what is what, you have no alternative but to try them all and take notes. Indeed, the manual actually invites you to do this!

You can chart only six data ranges, but you can specify several ranges in a single block, and you can generate a quick default chart in a single operation. Because Release 3.1 is a three-dimensional spreadsheet, the data series can be in separate worksheet pages or even in separate files—a design that makes it easy to build cross-sectional data series that bore through a set of worksheet pages. Thus, for instance, if you had a set of identically constructed pages tracking expenses at different branch offices, you could easily produce a bar graph comparing the same line item in the same time period at each branch.

NO BLANK SLATE

Wysiwyg lets you incorporate the current graph, a named graph, a .PIC file, or a CGM file in any worksheet location. Such embedded graphics are opaque by default, but you can make them transparent—which means that you can make use of underlying worksheet labels or data to annotate your graphs, as you can in *Allways*. But Wysiwyg has plenty of annotation features of its own, however, so you'll probably prefer to use those.

Wysiwyg's :Graph Edit command invokes the Wysiwyg equivalent of *Quattro Pro*'s Annotator—a set of drawing and text tools. Here you can add arrows, encircle points of interest, turn horizontal labels into verticals, and otherwise modify the appearance of your graph, as well as adding text. Like *Quattro Pro*, Wysiwyg allows you to create a blank graph, which you can use as a slate for drawing freeform images, creating text slides, or importing clip art.

Wysiwyg's font support is somewhat weaker than *Quattro Pro*'s. It does come with four Bitstream typefaces (Dutch, Swiss, Courier, and Symbols) in sizes from 3 to 72 points, and you can add more Bitstream fonts using *1-2-3*'s Install program. But it supports only three LaserJet cartridges.

There are a lot of good reasons, for some users, to adopt *1-2-3* Release 3.1. The three-dimensional worksheet, full compatibility with Release 2, powerful database features, and the availability of the Lotus Programming Language come quickly to mind. But presentation charting probably isn't one of them, because Release 3.1's graphics capabilities are just a little too clumsy for comfort.

Lotus 1-2-3/G

Lotus faced an unusual constraint in designing the charting component of *1-2-3/G*. On the one hand, the system had to integrate easily with future Presentation

other types of graphs such as hi-lo-open-close charts. You can use dashed and dotted lines as well as solid lines for any data range, and a skip factor lets you exclude data points at regular intervals, very useful for plotting trends from experimental data.

AN EXTRA DIMENSION

In bringing true 3-D bar graphs, line graphs, and surface plots to *1-2-3*, *3D Graphics* goes well beyond what's available in most business-oriented graphics programs. *3D Graphics* offers financial bar graphs (in which negative values descend from the zero plane and are displayed in a contrasting color for emphasis) as well as regular ones. Its 3-D surface plots let you use color to distinguish up to 15 contour levels and offer a clipping option to limit the range of your plots to significant areas.

All 3-D charts give you the option of three viewpoints (high, medium, and low) and let you rotate the graph to get different vantage points in 90-degree increments. This is adequate for analysis, but not good enough for presentation-quality output. Text labeling also leaves a lot to be desired: It offers no more than does *1-2-3* itself in the way of placement and font options, and the label of the nonplanar axis is set vertically, producing an unattractive effect.

GOOD, BUT

Both of these add-ins are viable alternatives for the *1-2-3* user. In particular, if you just need hi-lo-open-close charts or logarithmic scaling, *2D Graphics* fills in Release 2.2's major charting gaps and lets you avoid an upgrade to the much more complex Release 3.1. But both these add-ins are hobbled by the limitations of the Release 2 environment: the quality of the graphs is far from stunning, and the .PIC output format is not the most attractive or convenient. And though both *2D Graphics* and *3D Graphics* offer features of interest to technical types, they can't generate error bars directly, nor can they do curve fitting or graph theoretical functions.

Of course, you can use the spreadsheet's functions to make up for some of these deficiencies, but if you do lots of technical work, you may prefer to try one of the technical plotting packages reviewed in "Scientific Graphing Software: Not Just a Pretty Picture" (*PC Magazine*, March 14, 1989). Alternatively, you may want to consider a standalone charting package such as *Cricket Graph* ($199 from Computer Associates) which can give you attractive output and quite a range of both business and technical charting options for much less than a full-fledged presentation graphics package would cost.

2D Graphics, 3D Graphics
Intex Solutions Inc., 161 Highland Ave., Needham, MA 02194; (617) 449-6222.
List Price: *2D Graphics*, $145; *3D Graphics*, $145.
Requires: 56K free RAM.
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FACT FILE

Lotus 1-2-3/G
Lotus Development Corp., 55 Cambridge Pkwy., Cambridge, MA 02142; (617) 577-8500.
List Price: $695.
Requires: IBM AT or compatible, 4MB RAM (6MB recommended), hard disk, OS/2 1.1 or later. Mouse and EGA or VGA graphics adapter recommended.
In Short: Lotus's entry in the Presentation Manager sweepstakes offers nice graphics, with reasonably good control over charting options. It's missing in annotation features, however, and it can be quite slow in graphics operations.

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"Under NewWave, (Lotus) 1-2-3 gains a lot of features and functions it never even had under DOS, even though it's not a NewWave application."
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—PC Week

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—PC Week

"NewWave...is a significant step ahead, technologically, of anything already found in DOS and OS/2 user environments."
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—PC/Computing

"These are nice capabilities, but what makes the $195 NewWave more than just another pretty interface is its ability to use these objects to contain or manipulate other objects."*
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"NewWave's object management facility is its most powerful feature. The system treats a data file and the application that manipulates it as a single object. This enables users to invoke one application within another...NewWave's object management also lets users create hot links between objects to share and dynamically update data."
—InfoWorld

"Not Just Another Pretty Interface, NewWave Redefines Software Use."*
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"In addition to its object management features, NewWave overlays Microsoft Windows with a truly intuitive graphical front end, finally achieving Macintosh-like ease of use for the PC."
—Datapro

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†HP NewWave software requires Microsoft Windows 3.0 and an Intel 286 or 386 based PC with 640 Kb base and 2 Mb extended memory

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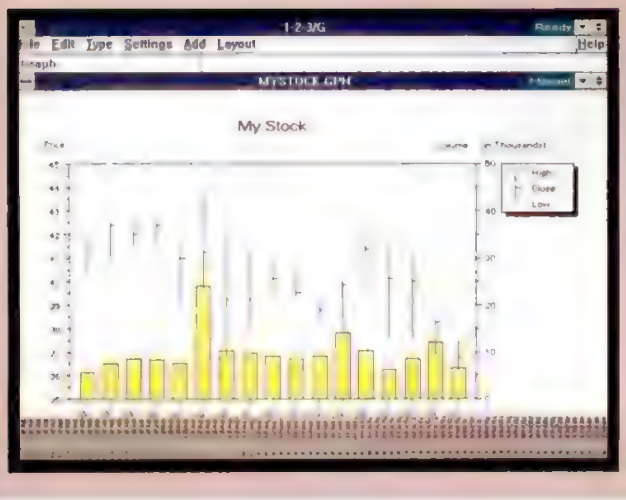


Lotus 1-2-3/G offers a simple Edit Link procedure that lets you assign a common graph specification—such as this stock chart—to many different sets of data in turn.

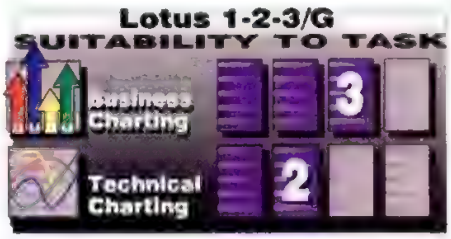
Manager products, such as *Freelance Graphics for OS/2*. On the other, it had to be keystroke, macro, and file compatible with earlier versions of *1-2-3*.

This need to look left with one eye and right with the other has led to two sets of commands for creating and modifying graphs. One is a new version of the familiar /Graph menu. The other is an entirely new menu bar more suited to PM's graphical standards. The /Graph menu appears in a component of the program called the Worksheet Tool; the new menu bar appears in a separate component called the Graph Tool.

KISSING COUSINS

Creating a graph with the /Graph menu is almost, but not entirely, like creating a graph in earlier versions of *1-2-3*. You can assign up to six data series, either individually or in groups, by pointing to a block of cells. If you do the latter, *1-2-3/G* interprets the series and values according to the shape of the block, as does *Excel*. Its Type command lets you choose from a fairly extensive repertoire of charts, and its Options command lets you assign title and legend text. The current graph can be named and attached to the worksheet from which it was generated for redisplay via /Graph Name Use.

Unlike in Releases 2 and 3 of *1-2-3*, *1-2-3/G* displays graphs in independent windows. The Graph Tool (which becomes current when you click on the graph window) lets you save the graph as an independent file in a proprietary .GPH format (.PIC is no longer supported). You can reload the .GPH file at any session, but the graph won't reflect changes to the underlying data unless all supporting worksheets are also open—and unfortunately, the program doesn't open them for you, or even warn you that the graph may not be current.



1-2-3/G's Graph tool offers a plentiful set of customizing commands. You can add, change, and format titles, text notes, and arrows. You can specify colors for data series, the plot area, and the legend background. You can choose from a variety of line styles and colors. And you can move titles, annotations, the legend, and even the plot area itself by dragging with the mouse. The ability to put titles and legend wherever you want them (rather than in fixed locations) is unusual and is very helpful in avoiding the four-square appearance that's so typical of computer-generated charts.

You'll find no box or freehand drawing tools and no clip art in *1-2-3/G*. However, these omissions are deliberate; for such adornments, Lotus expects you to use its new *Freelance Graphics for OS/2*, a full-featured presentation graphics package. The two programs share a charting module that can be called up from either package, so this process is less difficult than it would be if you had to import chart files from disk.

BETWEEN TWO WORLDS

The segregation of functionality into a Graph menu and a Graph Tool seems like a fine idea at first, since it lets *1-2-3/G* combine Release 2-like behavior (graphs saved in worksheet files) with *Excel*-like behavior (graphs saved independently). But it doesn't allow graphs to be printed alongside worksheet data, and its implementation is troublesome on two counts.

First, not all of the Release 2 and Release 3 graph commands are supported, and some command sequences have been changed. For instance, to reset graph parameters, you must type /Graph Reset and answer a confirmation prompt instead of using /Graph Reset Graph with no confirmation prompt. The procedure for assigning data ranges involves several extra steps, and most of what used to be on the Options submenu has been removed and delegated to the Graph Tool. All of this

Lotus 1-2-3/G produces snappy 3-D bar graphs, though you can't rotate them for optimum viewing angle.

A brilliant idea is not subject to a time clock.

Or a particular place.

The spark can ignite at any hour.

Anywhere.

At home, in those few luminous moments

just before sleep comes.

In the shower.

On a train.

Such moments of inspiration are precious.

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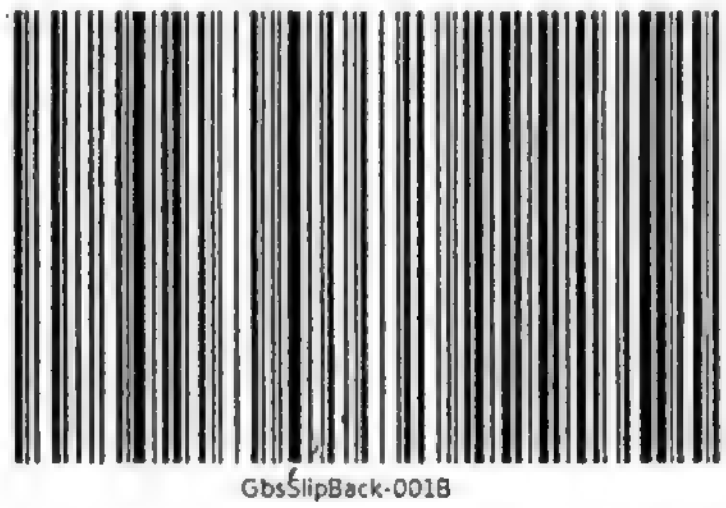


Back

1. Follow instructions on the other side

Inverted Back

1. Follow instructions on the other side

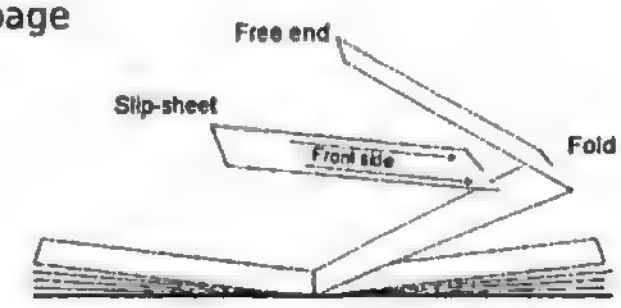
Folded edge of the page

Inverted Foldout slip-sheet

GbsSlipSheet-001

Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
   1. Front side touching the free page
   2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



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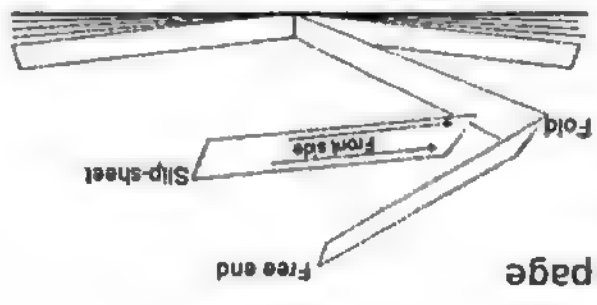

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The freedom of one.

386sx
CPU:
20 MHz.
WEIGHT:
6.0 lbs.
SCREEN:
10" diag. VGA LCD.
MEMORY:
2MB, expandable
to 4MB.
BATTERY LIFE:
up to 3 hours,
recharges in 5 hours.
EXPANSION:
2MB RAM slot,
modem/fax.

286
WEIGHT:
6.0 lbs.
CPU:
12.5 MHz.
SCREEN:
10" diag. VGA LCD.
MEMORY:
1MB, expandable
to 3MB.
BATTERY LIFE:
up to 3.5 hours,
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In two models.

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SPREADSHEET GRAPHICS: SUMMARY OF FEATURES

Products listed in ascending price order

This table compares the charting and annotation features of the spreadsheets we reviewed. The corresponding capabilities of two leading presentation graphics programs, *Lotus Freelance Plus* and Software Publishing Corp.'s *Harvard Graphics*, are included for comparison, as are those of Lotus's automated charting program, *Lotus Graphwriter II* (see the sidebar "Charting in Bulk"). An explanation of some of the terms used in the table follows.

Bar charts A yes answer means that the package will produce various standard types of bar charts, in either horizontal or vertical orientation. (The *combination* chart, also called a *mixed* chart, consists of a line chart superimposed over a bar chart.)

Pie charts indicates that the package can produce 2-D and 3-D pie charts, as well as some of the following pie chart options: *Exploded* indicates the ability to separate one or more pieces of the pie for emphasis; the separation can be done either by setting a *user-defined distance* or by directly manipulating the pie pieces with a mouse (*yank and place*). *Multiple linked pies* means that you can create a chart containing two or more pies whose values are related mathematically; *proportional pies* means that you can create a chart with two or more pies whose sizes are proportional to their total values.

Line and area charts Packages may provide ordinary *line charts*, *scatter charts* that show points on an *x,y* grid, and two types of area charts: *stacked charts*, in which the points on the *y*-axis are cumulative totals, and *unstacked charts*, in which the areas overlap.

Text charts Packages offer a range of features useful in creating word charts, such as *formatted lists* of items in outline form, *multicolumn tables*, or *word-wrap text*. Other options include the ability to format titles with a given font and color (*formatted titles*) and the ability to specify different types of bullets for each outline level (*automatic bullets*).

Miscellaneous charts These include options for creating *flowcharts*, *organization charts*, *Gantt charts* (used in project management), *hi-lo-open-close charts* (used for stock quotes), and *pictographs* (which show the values of the variables in proportionally sized pictures). Note that this last option is not the same as the ability to create such graphs using freehand drawing tools.

Technical charts Some packages offer various types of graphs of interest to those in scientific and technical fields: *polar graphs*, *surface plots*, *histograms*, and true *three-dimensional bar charts* that show data on the *x*, *y*, and *z* axes.

Technical scaling options include support for various types of logarithmic scaling, plus the ability to create graphs with *multiple y-axes* for easier comparison of trends with widely different baselines.

Error bars means that the package can generate error bars automatically for data points, showing the margin of error by a given amount or percentage, or as a standard deviation. Note that some products can simulate error bars using hi-lo-open-close charts, but in such cases the margin of error must be calculated in the underlying spreadsheet.

Curve fitting means that the product can use regression techniques to calculate the curve that best fits a given set of data points.

Scientific symbols and Greek letters indicates that you can use scientific symbols and Greek letters in chart titles, legends, and annotations.

Per-chart maximums shows the limits on the product's capabilities: the number of data points per series and the number of series and points per chart, as well as the maximum number of line types, line symbols, fill patterns, and colors per chart. Note that "unlimited" means that there is no limit fixed by the program's design. In practice, however, these values will be limited by the amount of RAM in your machine.

Combine charts indicates the ability to overlay any chart upon any other chart. This option can be used to create mixed bar/line charts or to superimpose line charts on scattergrams and other chart types.

Quick graph option lets a spreadsheet generate an appropriate default chart automatically, simply by specifying the data range to graph.

Modify elements separately indicates which elements of a chart can be modified independently: chart legends, titles, *x*- and *y*-axis labels, colors or fill patterns, scales, data labels, and chart borders.

Edit text directly on chart means that you can edit text by clicking directly on a text element (such as a legend or title) rather than by selecting it through a menu option.

Scale chart means that the entire chart can be resized, either in discrete steps (half-size, quarter-size, and so on) or by a specified proportion. *Scale to fit* means that you can scale a chart to fit within a given area.

Rotate chart lets you rotate the chart, either in fixed settings (portrait and landscape orientations, for example) or in increments.

Text styling options are special effects that you can apply to individual letters: boundary boxes, drop-shadow effects, or specific colors.

Text alignment options are tools for positioning text on the page: justifying text left, right, or center, aligning text on a horizontal or vertical line, rotating text a given number of degrees, indenting it from the left margin, or setting margins. *Shrink text to fit box* is the ability to adjust the font size according to the size of the bounding box and the length of the text passage so that all the text fits within the box.

Number of scalable fonts included Many spreadsheets come equipped with scalable fonts that can be used in graphics as well as in printing the worksheet. This table also indicates the minimum and maximum type sizes that the spreadsheet supports, as well as whether the font set includes a symbol or dingbat font with items such as bullets and arrowheads.

Spell-checker checks the spelling of titles, legends, annotations, and other text elements of a graphic chart.

Drawing tools let you draw freehand lines, arrows, and shapes on your charts, and cut, copy, or paste images.

Group/ungroup elements means that the program lets you ungroup the various objects that compose a vector image for editing and then regroup them into a single image.

Import bitmapped images indicates whether you can incorporate bitmapped images such as logos and scanned art into your charts and, if so, the formats supported. *Paint tools* can be used to edit such images.

Clip art If the product comes with clip-art images that you can use in your charts, this section notes how many images the package contains and whether more can be purchased at extra cost from the vendor. *Import file formats* indicates which vector formats the product can import.

Graphics adapters indicates the types of graphics adapters and on-screen graphics modes supported. *Super VGA* support indicates that the product comes with drivers for at least one board that lets it display resolutions and colors beyond the maximum supported by a standard VGA card. Note that with *Windows* and Presentation Manager programs, video support is a function of the underlying graphical environment.

Printers indicates the product's support for the most important types of black-and-white and color printers. Support for *plotters* (for color overheads) and *film recorders* (for slides) is also indicated.

Export file formats indicates the product's ability to export completed charts in a variety of common vector file formats: Computer Graphic Metafile (CGM), *Windows* Metafile (.WMF), Encapsulated PostScript (.EPS), the Hewlett-Packard Plotter Language (HPGL) format supported by a wide variety of plotters and CAD programs, the .PIC format in which *Lotus 1-2-3* graphs are saved, and the .DXF interchange format supported by *AutoCAD* and other CAD programs.

CONTINUES

SPREADSHEET GRAPHICS: SUMMARY OF FEATURES

Products listed in ascending price order

	Lotus 1-2-3, Release 2.2 $495	Microsoft Excel $495	Quattro Pro $495	Wingz $495	Lotus 1-2-3, Release 3.1 $595	Lotus 1-2-3/G $695
BUSINESS CHARTS						
Bar charts (vertical/horizontal):						
Plain	■/□	■/■	■/■	■/■	■/■	■/■
Stacked	■/□	■/■	■/□	■/■	■/■	■/■
Overlapped	□/□	■/■	□/□	■/■	□/□	■/■
Clustered	■/□	■/■	■/■	■/■	■/■	■/■
Shaded 3-D	□/□	□/□	■/■	■/□	□/□	■/□
Combination	□/□	■/■	■/□	■/□	■/■	■/■
Pie charts:						
2-D	■	■	■	■	■	■
3-D	□	□	■	■	□	□
Exploded	■	■	■	■	■	■
User-defined distance	□	■	□	■	□	■
Yank and place	□	■	□	□	□	■
Multiple linked pies	□	□	□	□	□	□
Proportional pies	□	□	□	■	□	□
Line and area charts:						
Line chart	■	■	■	■	■	■
Scatter chart	■	■	■	■	■	■
Stacked (cumulative) area chart	□	■	■	■	■	■
Unstacked area chart	□	■	□	■	□	□
Text charts:						
Formatted lists	□	□	■	■	■	■
Multicolumn tables	□	□	□	■	■	■
Word-wrap text	□	□	■	■	■	■
Formatted titles	□	□	■	■	■	■
Automatic bullets	□	□	■	■	□	□
Miscellaneous charts:						
Flowchart	□	□	□	□	■	■
Organization	□	□	□	□	■	■
Gantt	□	□	□	□	□	□
Hi-lo-open-close	□	■	■	□	■	■
Pictograph	□	□	□	□	□	□
SCIENTIFIC AND TECHNICAL CHARTS						
Technical charts:						
Polar graphs	□	□	□	■	□	□
Surface plots	□	□	□	■	□	□
Histograms	□	□	□	■	■	□
3-D bar charts	□	□	□	■	□	■
Technical scaling options:						
Linear	■	■	■	■	■	■
Log-linear	□	■	■	■	■	■
Log-log	□	■	■	■	■	■
Multiple y-axes	□	■	■	□	■	■
Error bars	□	□	□	□	□	□
Curve fitting	□	□	□	□	■	■
Scientific symbols and Greek letters	□	■	□	□	□	□
GENERAL CHARTING OPTIONS						
Per-chart maximums:						
Data points per series	Unlimited	2,000	Unlimited	Unlimited	32,767	4,000
Data series per chart	6	256	6	Unlimited	6	23
Data points per chart	Unlimited	8,100	Unlimited	Unlimited	32,767	92,000
Number of line types	1	5	8	24	1	8
Number of line symbols	6	3	10	16	6	10
Number of fill patterns	6	16	16	24	14	16
Number of colors available	6	16	16	16.7 million	224	16
Combine charts	□	■	■	■	■	■
Quick graph option	□	■	■	□	■	■

□—Editor's Choice ■—Yes □—No

INCLUDED FOR COMPARISON		
Lotus Freelance Plus $495	Harvard Graphics $495	Lotus Graphwriter II $495
■/■	■/■	■/■
■/■	■/■	■/■
□/□	■/■	□/□
■/■	■/■	■/■
■/■	■/■	■/■
■/■	■/■	■/■
■	■	■
■	■	□
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■	■	■
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■	■	■
□	□	□
■	■	■
■	■	□
500	240	500
8	8	8
2,000	240	500
8	4	7
9	13	8
15	12	15
15	16	12
■	■	□
■	□	■

CONTINUES

means that most Release 2 and Release 3 macros that manipulate graphs not only won't work in *1-2-3/G*, but can't even be made to work with its macro-translation utility.

Second, while the Worksheet Tool's Graph menu offers seven different graph types—line, area, bar, stacked bar, 3-D bar, pie, and *x,y*—the Graph Tool's Type menu offers nine—all of the foregoing, plus overlapped bar and high-low-open-close charts. The Graph Tool also lets you create horizontal variants. Though the two command sets are comprehensible on their own, the difference between them can be baffling.

PERFORMANCE HITS

Undoubtedly, you can get used to these quirks and others; you'll probably do most of your graphics work in the Graph Tool, so its irritating differences with the /Graph menu will not matter. But what you may never get used to is *1-2-3/G*'s sluggish performance. On a 25-MHz Compaq 386 with 4MB RAM, the creation of a simple bar graph consistently took *1-2-3/G* about 27 frustrating seconds, and closing the graph window took another 12 seconds in our tests. Almost every menu command gave the program a new reason to visit the hard disk.

More memory should improve matters somewhat. But since delays persisted during a session exclusively devoted to graphing, one must believe that *1-2-3/G* is simply not well tuned for graphics performance. This is a serious detraction in what is otherwise a fine spreadsheet with excellent graphics.

PC MAGAZINE FACT FILE
EDITOR'S CHOICE

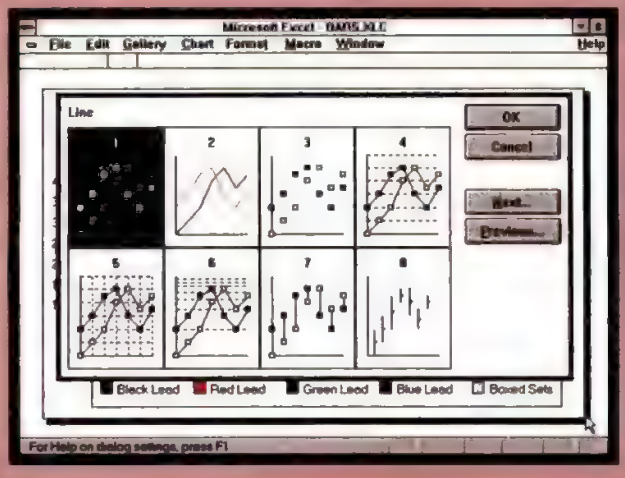
Microsoft Excel
Microsoft Corp., One Microsoft Way, Redmond, WA 98052; (206) 882-8080.
List Price: $495.
Requires: IBM AT or compatible, 1MB RAM, hard disk, mouse, DOS 3.0 or higher, *Microsoft Windows* 2.1 or 3.0. EGA or VGA graphics adapter recommended.
In Short: Though some annoying quirks persist, this old standby's graphics capabilities still look very good next to those of most of its competitors. Its clearly designed chart gallery, ability to use *Windows* fonts, and decent range of annotation capabilities should meet most needs.

CIRCLE 423 ON READER SERVICE CARD

Microsoft Excel

During most of its existence, *Microsoft Excel* has been the clear choice for PC users wanting the most in spreadsheet-driven graphics. Today, however, the program is beginning to show its age. It hasn't been revised significantly since it appeared three years ago, and in the meantime its challengers have gone a long way in catching up with its abilities.

Even so, our inspection shows that *Excel* still has plenty of drawing power. Its attractions include a full range of business chart types, simple graph-creation procedures, intelligent defaults, many customizing options, and easy data exchange (via DDE and the Clipboard) with the growing number of other applications that also run under *Windows*.



Microsoft Excel **displays the most common variations on the basic graph types in an easy-to-use chart gallery. In this Line gallery, for example, you can select any variation with a single mouse click.**

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Sales results based on worldwide installed base of lap tops, per 1989 Dataquest Inc. study Customer satisfaction results based on PC Magazine 9/26/90 issue

MORE PORTABLES THAN ANYONE ELSE.

Next, you'll find the keyboard to be immediately familiar, since it's what you're already used to. All of the key spacing and sizes are standard.

You'll also discover plenty of processing power packed into the 286-based T1200XE. And the 20MB hard drive means you can keep all your programs and files right where you need them. With you.

Plus, you'll undoubtedly appreciate the T1200XE's other humane features like a slim line battery pack and AutoResume,™ which lets you pick up exactly where you left off. No grand reopening of the system, program and file every time you want to start work again.

The only thing you'll notice we've skimped on is size and weight. After all, what good is a portable if you can't take it with you?

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With notebooks like the T1200XE it should come as no surprise that Toshiba sells more portable PCs than any other company in the world. After all, you're not the only one who recognizes a good thing when they see it.

In Touch with Tomorrow

TOSHIBA

CIRCLE 379 ON READER SERVICE CARD

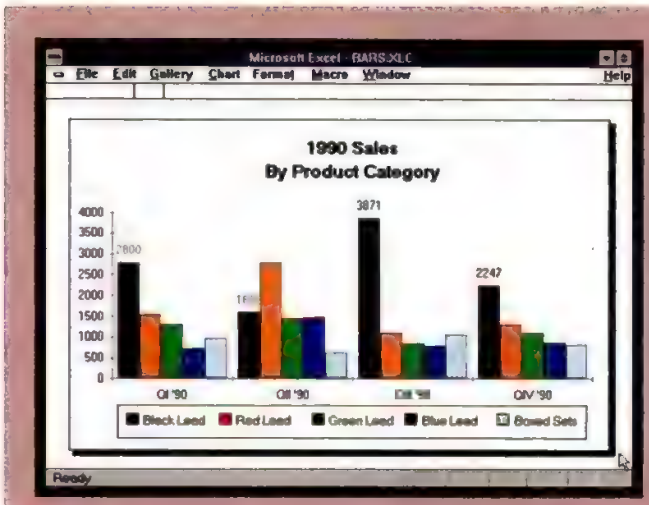
SPREADSHEET GRAPHICS: SUMMARY OF FEATURES

	Lotus 1-2-3, Release 2.2	Microsoft Excel	Quattro Pro	Wingz	Lotus 1-2-3, Release 3.1	Lotus 1-2-3/G
CHART FORMATTING OPTIONS						
Modify elements separately:						
Legends	■	■	■	■	■	■
Titles	■	■	■	■	■	■
x- and y-axis labels	■	■	■	■	■	■
Colors or patterns	❑	■	■	■	■	■
Scales	■	■	■	■	■	■
Data labels	■	■	■	■	■	■
Borders	❑	■	■	■	❑	■
Edit text directly on chart	❑	■	■	■	■	■
Scale chart	■	■	■	■	■	■
Scale to fit	❑	■	■	❑	■	■
Rotate chart	■	❑	❑	■	■	■
TEXT OPTIONS						
Text styling options:						
Boxed letters	■	■	■	■	■	■
Drop shadows	❑	■	■	■	■	■
Text color	■	■	■	■	■	■
Text alignment options:						
Justification	■	■	■	■	■	■
Alignment	■	■	■	■	■	■
Text rotatation	❑	■	❑	❑	❑	■
Indentation	❑	■	❑	■	❑	❑
Margins	❑	■	■	■	■	❑
Shrink text to fit box	❑	■	❑	■	■	❑
Number of scalable fonts included	11	3	9	None (uses *Windows* fonts)	4	None (uses PM fonts)
Minimum/maximum type size	5–14 points	1–409 points	6–72 points	N/A	3–72 points	N/A
Includes dingbats	❑	❑	■	N/A	■	N/A
Spell-checker	❑	❑	❑	❑	❑	❑
ANNOTATION FEATURES						
Drawing tools:						
Line	❑	■	■	■	■	■
Box	❑	■	■	■	■	❑
Arc	❑	❑	❑	■	❑	❑
Oval	❑	❑	■	■	❑	❑
Circle	❑	❑	■	■	❑	❑
Ellipse	❑	❑	■	■	■	❑
Freehand curve	❑	❑	■	■	■	❑
Arrow	❑	■	■	❑	❑	■
Cut/copy/paste	❑	■	■	■	■	■
Group/ungroup elements	❑	❑	■	■	❑	❑
Import bitmapped images	❑	❑	❑	.PCX, .BMP	❑	❑
Paint tools	❑	❑	❑	❑	❑	❑
Use clip art	❑	❑	■	■	■	❑
Number of clip-art images included	None	None	64	None	4	None
More available at extra cost?	❑	❑	■	❑	■	❑
File formats imported	None	.WMF	None	.WMF	CGM, .PIC	None
Mouse support	❑	■	■	■	■	■
DEVICE SUPPORT						
Graphics adapters:						
Hercules	■	■	■	■	■	❑
EGA	■	■	■	■	■	■
VGA	■	■	■	■	■	■
Super VGA	❑	■	❑	■	❑	■
IBM 8514/A	❑	■	❑	■	❑	■

❑—Editor's Choice ■—Yes ❑—No
N/A—Not applicable: the product does not have this feature.
* *Harvard Graphics* scales type as a percentage of total image size.

INCLUDED FOR COMPARISON	Lotus Freelance Plus	Harvard Graphics	Lotus Graphwriter II
	■	■	■
	■	■	■
	■	■	■
	■	■	■
	■	■	■
	■	■	■
	■	■	■
	■	■	□
	■	■	□
	■	■	□
	■	■	■
	□	□	■
	■	■	□
	■	■	■
	■	■	□
	■	■	■
	■	■	□
	■	■	□
	■	■	□
	■	■	□
	□	□	□
	7	7	8
	1–100 points	0–100 percent*	0–100 mm.
	□	□	□
	□	■	□
	■	■	□
	■	■	□
	■	■	□
	■	■	□
	■	■	□
	■	■	□
	■	■	□
	■	■	□
	■	■	□
	■	■	□
	■	■	□
	■	■	□
	TIFF	□	□
	□	□	□
	■	■	□
	900	503	N/A
	■	■	N/A
	CGM, .PIC	CGM, .PIC	CGM, .PIC
	■	■	■
	■	■	■
	■	■	■
	■	■	■
	□	□	□
	□	□	□

CONTINUES



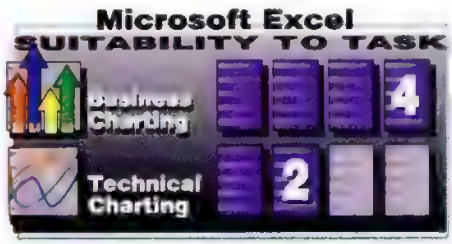
***Microsoft Excel* lets you apply labels to individual data points as well as to all the points in a series. You can format them individually, though you can't adjust their positions to avoid collisions.**

POINT AND GRAPH

To create a graph in *Excel*, you just drag the mouse across your data block and open a new chart window. *Excel* then creates a plot according to the shape of the data block. If your selection has more columns than rows, each row becomes a data series; if the opposite is true, each column becomes a series. Words adjacent to numbers become either *x*-axis or legend labels, as appropriate. The program is even smart enough to recognize that dates, although values, are to be treated as labels in a charting context.

This "select and shoot" approach to charting is no longer unique; *Wingz* and *1-2-3/G* offer similar capabilities, and both *1-2-3* Release 3.1 and *Quattro Pro* have "quick graph" features that let you create a default graph with a single command simply by marking a block with the cell pointer. *Excel* still has an edge, however, when it comes to ease of use. Its Gallery command gives you a visual menu of not just the basic seven chart types—vertical bar, horizontal bar, line, area, pie, *x,y*, and combination—but also of the most commonly needed variants. You can switch from clustered bar to stacked bar, for example, by pointing to a picture in a dialog box.

Changing colors or fill patterns is also easy: Simply point to what you want to change, issue a menu command, then fill out another dialog box. Unfortunately, you'll be doing this all too frequently unless you use a color printer for your output. *Excel*'s default solid color fills are attractive on screen, but on paper they look like shades of mud.



MANY ALTERNATIVES

You can add two kinds of text to an *Excel* chart. Attached text is associated with particular chart elements—the axes, the title area, or particular data points—and can't be moved. But you can put unattached text and arrows wherever you want. Either kind can be displayed in any font known to *Windows*; however, you can't have more than four fonts active in *Excel* at any one time. When you attach text to data points, *Excel* displays the points' values by default, but you can override that choice with any other words or numbers of your choosing. Unlike many other programs, *Excel* also allows you to annotate individual points without annotating the entire series.

Excel has many other customizing options, most of which will send you to the manual for study. For example, you can plot noncontiguous data ranges by creating a "multiple selection" before opening the new chart window, but if you want to add a range to an existing graph, you need to perform a copy-and-paste procedure—a technique that won't be immediately obvious if you're accustomed to Lotus-style spreadsheets in which you assign data series individually. Creating a graph that contravenes the default range-parsing scheme requires the use of the

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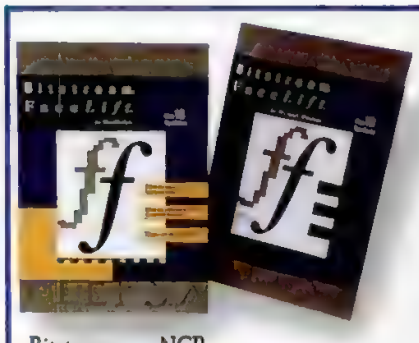

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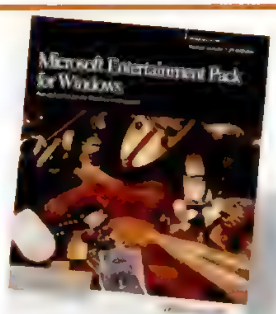

Microsoft ... NCP
7881 ☐ *Entertainment Pack for Windows 1.0*—A collection of games and a screen saver made especially for Microsoft Windows 3.0. The perfect gift for any Windows user! ... $29.

American Power ... 2 years
7108 APC Smart-UPS 400 ..... 339.
6811 360SX *(stand-by power source)* ... 219.
7107 450AT *(stand-by power source)* ... 279.
7106 520ES *(stand-by power source)* ... 329.

AST Research ... 2 years
1299 SixPakPlus 384k C/S/P ..... 179.
8041 SixPak 286 0k ..... 105.
4107 RAMpage Plus 286 512k ..... 419.
4105 RAMpage Plus MC 512k ..... 419.
6979 VGA Plus Video Card *(256K expandable to 512K)* ..... 199.

Boca Research ... 5 years
7001 BOCARAM/AT PLUS *(0-8 Meg) (LIM 4.0 extended)* ..... 125.
7061 BOCARAM/XT 0K *(0-2 Meg, LIM 4.0)* 99.
7135 TophAT *(16-bit backfill 512K to 640K)* 99.
6998 I/O Board for AT ..... 59.
6999 I/O Board for Microchannel S/S/P . 109.
6995 SuperVGA *(800 x 600, 16/8 bit)* ... 115.
7026 1024 VGA *(16 bit non-interlaced)* .. 149.

CH Products ... 1 year
Pick the stick the pros use, & the thrills are on us. FlightStick w/FREE Falcon! New two-port, automatic gamecards complete the package.
8119 *FlightStick w/Falcon & GameCard III* $79.
8120 *FlightStick w/Falcon & GameCard MCA* 95.

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Intel ... 5 years
80287XL & 80287XLT Math CoProcessors—Runs up to 50% faster than other 80287 math chips. The 80287XL works in virtually every 80286-based PC, and the 80287XLT is made especially for Compaq LTE/286.. **each $199.**

Bravo Communications ... 2 years
7400 2 Pos. Laser Compatible Switch Box 109.
Brother International ... 1 year
5787 HL-8e Laser Printer *(HP2 comp.)*. 1399.
Canon ... 1 year
7894 BJ-10e BubbleJet Printer *(4.6 lb.)* . 349.
7896 Sheet feeder for BJ-10e . . . . . 75.
CH Products ... 1 year
7341 Gamecard III Plus *(for Microchannel)* 49.
7935 Gamecard III - Automatic . . . . . 33.
8119 FlightStick w/Falcon & GameCard III . 79.
8120 FlightStick w/Falcon & GameCard MCA 95.
7345 Rollermouse *(Trackball) serial* 85. *bus* 99.
Compucable ... 2 years
1604 2-Position switch box . . . . . 25.
1605 3-Position switch box . . . . . 35.
Cuesta Systems ... 1 year
1608 400 Watt DataSaver . . . . . 429.
5130 600 Watt DataSaver . . . . . 599.
Curtis ... lifetime
1704 Universal Printer Stand PS-1 . . . . . 18.

Intel ... 5 years
2346 Inboard 386/PC with Free Samna Ami—Gives you 80386 processing power, 1 Mb RAM, and Samna's powerful Windows-based word processor (regularly at $129). 30 Day Money Back Guarantee. . . . . **$519.**

1694 Emerald SP-2 . . . . . $36.
1708 Ruby-Plus SPF-2 Plus . . . . . 65.
7358 Command Center. . . . . 93.
Glass Filter Plus *(specify size)*. . *ea.* 65.
Data Technology ... 1 year
6249 5280 *(AT Floppy/Hard Controller)*. . 119.
6248 7280 *(AT Floppy/Hard Controller)* . 129.
Datadesk ... 3 years
6901 Switchboard . . . . . 175.
Epson ... 1 year
We are an authorized Epson Service Center.
1906 FX-850 *(80 col., 264 cps, 9 pin)* . . . call
1904 FX-1050 *(136 col., 264 cps, 9 pin)*. . call
5183 LQ-510 *(80 col., 180 cps, 24 pin)*. . . call
1930 LQ-850 *(80 col., 264 cps, 24 pin)* . . call
1917 LQ-1050 *(136 col., 264 cps, 24 pin)* call
5184 LX-810 *(80 col., 180 cps, 9 pin)*. . . . call
1052 Printer-to-IBM cable *(6 feet)*. . . . . 15.
7775 Equity LT-286e Laptop. . . . . 1995.
7774 Equity LT-386SX Laptop . . . . . 3069.
Removable Hard Drives for Epson Laptops
7776 *20 Meg* . . 499. 7777 *40 Meg* . . 699.

Intel ... 5 years
Above Boards—FREE Quarterdeck QRAM and Manifest with any Above Board or piggyback, now through December 31, 1990! . . . . . **see Intel listing for prices.**

5th Generation ... 1 year
7157 Logical Connection Plus 512k . . . . 599.
Hayes ... 2 years
2307 Smartmodem 2400. . . . . 349.
8049 JT-FAX 9600B. . . . . 499.
7391 Ultra 9600 Modem . . . . . 899.
Hewlett-Packard ... 1 year
7976 DeskJet 500 *(w/ink cartridge)* . . . . 599.
6754 LaserJet III *(w/toner)* . . . . . 1699.
6582 LaserJet IIP *(w/toner)* . . . . . 1069.
Intel ... 5 years
6421 2400B MNP Internal Modem . . . . 199.
4696 2400B Internal Modem . . . . . 159.
2352 2400B Internal Modem 2 *(for PS/2)* 249.
5119 2400 Baud External Modem . . . . . 179.
6420 2400EX MNP Modem. . . . . 229.
7880 9600EX Modem . . . . . 549.
2346 Inboard 386/PC w/1 Meg *(w/free Ami)* 519.
2348 Inboard 386/PC w/1 Meg Piggyback 349.
4646 Inboard 386/PC w/4 Meg Piggyback 669.
4266 Above Board Plus 512k. . . . . 369.
4267 Above Board Plus I/O 512k . . . . . 399.

Intel ... 5 years
7880 9600EX Modem—Provides ultra-fast data communications without sacrificing compatibility. Supports V.32 & V.42 9600 bps operation, as well as MNP Level/5 and Hayes compatible 2400/1200/300 bps modes . **$549.**

5336 Above Board Plus 8 2 Meg . . . . . 599.
5342 Above Board Plus 8 I/O 2 Meg . . . 629.
4272 Above Board 2 Plus 512k . . . . . 469.
5396 Above Board MC 32 0k . . . . . 359.
7782 SatisFAXtion *(fax board)* . . . . . 399.
7552 NetPort *(3 year warranty)*. . . . . 489.
MATH COPROCESSORS
7385 80287XL *(16 MHz 80286 CPU's)*. . . 199.
4750 80387SX *(16 MHz 80386SX CPU's)* 309.
2371 80387 *(16 MHz 80386 CPU's)*. . . . . 349.
2372 80387-20 *(20 MHz 80386 CPU's)* 399.
4121 80387-25 *(25 MHz 80386 CPU's)* 429.
2375 8087 *(4.77 MHz 8088 CPU's)* . . . . . 89.
2374 8087-2 *(8 MHz 8088 CPU's)* . . . . . 129.
Kensington Microware ... 1 year
2582 Master Piece Plus . . . . . 109.
7899 Expert Mouse *serial*. . 119. *bus*. . 129.
Key tronic ... 3 years
4518 101 Plus Keyboard . . . . . 99.
Kraft ... 5 years
5800 3 button Thunder Joystick. . . . . 29.
5802 Trackball. . . . . 59.
7912 G/S+ *(microchannel game card)* . . 79.
5831 Game Card/Thunderstick Bundle . . 55.
7581 KI30 Joystick . . . . . 29.
7862 TopTrack *(Laptop Trackball)*. . . . . 79.
Logitech ... limited lifetime
5464 C9 Mouse for PS/2's. . . . . 69.
7768 C9 Mouse with Windows. . . . . 149.
5151 HiREZ Mouse (C9) . . . . . 85.
6029 Trackman *(Trackball) serial* 85. *bus* 89.
4297 ScanMan Plus *(hand scanner)* . . . 185.
4794 ScanMan Plus *(MicroChannel)* . . . 219.
7975 ScanMan 256 . . . . . 319.
Magnavox ... 1 year
5990 CM9032 *(13" VGA Monitor, .42 dot pitch)* . . . . . 299.
4762 9CM082 *(13" VGA Monitor, .31 dot pitch)*. . . . . 349.
Micron Technology ... 2 years
7595 Intensify 2 Meg Expansion for HP LaserJet IIP or III . . . . . 175.
6668 Intensify 2 Meg Expansion for HP LaserJet II or IID . . . . . 219.

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Microsoft Press
Best MS-DOS & Windows computing books.
8127 *Working with Word for Windows* $20.
8126 *Running with DOS (4th Edition)* ..... 20.
8129 *Running Windows (2nd Edition)* 22.
8136 *Running Microsoft Excel* 22.

6670 Intensify 4 Meg Expansion for HP LaserJet II or IID ..... 357.
7012 Beyond Memory Board for PS/2 Model 70 *(2 Meg)* ..... 265.
Microsoft ... lifetime
7597 Microsoft Mouse ..... 89.
2897 Mouse with Paintbrush ..... 109.
2898 Mouse with Windows 3.0 ..... 149.
MicroSpeed ... 1 year
PC-TRAC Trackball *(incl. copy of Welltris)*
6007 *serial* ..... 75. 6008 *bus* ..... 85.
7271 *Inport* ..... 79. 6330 *PS/2* ..... 79.
Mouse Systems ... lifetime
5997 Trackball *(1 yr. wrnty.) serial* 75. *bus* 85.
7878 PC Mouse III ..... 99.
NEC ... 2 years
4799 Multisync 2A *(VGA Monitor)* ..... 499.
5085 Multisync 3D Monitor ..... 689.
Orchid Technologies ... 4 years
7064 Peanut VGA *(256k)* ..... 129.
7512 ProDesigner VGA II *(1024 x 768)* .. 299.
7888 ProDesigner/e *(256k)* ..... 209.
7097 8/16 Memory Card *(1 Meg)* ..... 349.
PC Power & Cooling ... 1 year
REPLACEMENT POWER SUPPLIES
3202 Turbo Cool 150 *(25° - 40° cooler)* . 129.
7915 Turbo Cool 300 ..... 165.
3200 Silencer 150 *(84% noise reduction)* 115.
7053 Innersource 2210 *(internal UPS)* .. 399.
Pacific Data Products ... 1 year
6779 25 Cartridges in One! *(for LJ II, IIP, IID)* 275.
7072 25 Cartridges in One! *(for LJ III)* ..... 349.
Memory upgrade for LaserJet IIP/III
7054 *1 Meg* ... 149. 7055 *2 Meg* ... 199.
7758 *3 Meg* ... 279. 7759 *4 Meg* ... 339.
Memory upgrade for LaserJet II
6839 *1 Meg* ... 179. 6838 *2 Meg* ... 249.
Memory for Tec Engine Laser Printers
7634 *2 Meg* ... 219. 7633 *4 Meg* ... 369.
7158 Pacific Page *(PostScript Cartridge for LaserJet IIP/III)* ..... 379.
6834 Pacific Page with free 2 Meg Memory Board *(for LaserJet II)* ... 379.
7632 Outlines I . 209. 7631 Outlines II . 209.

6831 Plotter in a Cartridge *(LJ IIP, IID, III)* $249.
6832 Plotter in a Cartridge *(for LJ II)* ..... 249.
6835 Headlines in a Cartridge *(LJ II, IIP, IID)* 209.
7324 Pacific Print *(for Novell LANS)* .... 235.
Practical Peripherals ... 5 years
3101 1200 Baud Internal Modem ..... 65.
3100 1200 Baud External Modem *(mini)* . 77.
3103 2400 Baud Internal Modem ..... 135.
3102 2400 Baud External Modem ..... 179.
5286 2400 Baud Int. MNP Modem *(Lev. 5)* 175.
5285 2400 Baud Ext. MNP Modem *(Lev. 5)* 209.
4542 2400 Baud Internal Modem for PS/2 . 229.
8132 PM2400 Pocket Modem ..... 99.
7934 PM9600SA ..... 489.
PSION .. 1 year
7086 MC600 Mobile Computer ..... 2149.
7090 512K Flash EPROM ..... 309.
7962 3½" External Drive ..... 299.
Reflection Technology .. 1 year
7127 Private Eye *(virtual display)* ..... 499.
SAFE Power Systems ... 2 years
4561 Safe 250W ..... 199.
6747 Safe 400S *(Slimline)* ..... 399.

MicroSpeed ... 1 year
PC-TRAC Trackball—The PC Magazine Editor's Choice (8/90)! Ergonomically designed, it requires a desk space less than 4 inches wide.
6007 *Serial* .... $75. 6008 *Bus* .... $85.
7271 *Inport* ..... 79. 6330 *PS/2* ..... 79.

4562 Safe 425W ..... 329.
7913 Safe 650W ..... 459.
7914 Safe 800W ..... 599.
4560 Safe 1200W ..... 739.
Targus ... lifetime
4899 Nylon Laptop Carrying Case ..... 55.
7028 Foliopac ..... 79.
6037 Premier Leather Carrying Case ... 199.
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5140 TheComplete Page Scanner ..... 549.
8082 TheComplete Half Page Scanner/400 w/ReadRight Personal OCR Software 289.
6797 TheComplete Fax Portable ..... 319.

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SALES 603/446-7721 **FAX** 603/446-7791

Borland International ... NCP
1514 ▣*Paradox 3.5*—This powerful database manager is even stronger. It provides faster performance using less memory while managing any available expandable or extended memory (up to 16 Mb) .... $569.

4887 TheComplete Fax 9600 ..... 429.
5828 TheComplete Communicator .... 449.
4885 TheComplete Answering Machine 249.
8083 ReadRight Personal *(for TheComplete Half Page Scanner/400)* ..... 149.
Tripp Lite ... 2 years
6622 BC-200 *(200W Battery Backup)* ... 179.
6623 BC-325 *(325W Battery Backup)* ... 219.
6624 BC-450 *(450W Battery Backup)* .. 269.
7890 BC-750 *(750W Battery Backup)* .. 469.
7889 BC-1200 *(1200W LAN Backup)* ... 649.
7903 CCI6-12 *(Command Console)* ..... 69.
6018 LC-1200 *(1200W Line Conditioner)* 159.
6019 LS-600 *(600W Line Stabilizer)* ..... 85.
7979 LS-604 *(600W Line Stabilizer w/ORC Voltage Protection)* ..... 99.
6200 Isobar 6-6 *(6 outlets, 6 ft. cord)* .... 59.
6201 Isobar 8-12 *(8 outlets, 12 ft. cord)* .. 69.
6202 Isobar 8RM *(with remote control)* .. 79.
6198 Isoblok IB-2-0 *(2 outlets, no cord)* .. 29.
6203 Isotel *(4 outlets, RJ II protection)* ... 59.

RightSoft ... NCP
4155 ▣*RightWriter 4.0*—Now available! Premier grammar and style checker with more than 5,500 rules. Works within WordPerfect, Multimate, Microsoft Word, WordStar, Professional Write and Q&A Write ... $55.

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*DEFECTIVE SOFTWARE REPLACED IMMEDIATELY. DEFECTIVE HARDWARE REPLACED OR REPAIRED AT OUR DISCRETION.

We've got the story.

Video 7 ... 7 years

3778	Vega VGA	$155.
5883	1024i VGA *(includes 512k)*	219.
4931	VRAM VGA 512k	379.

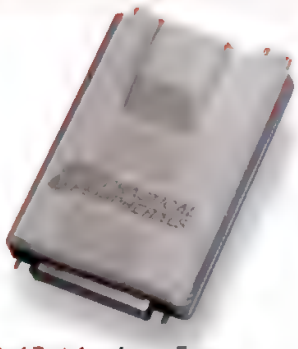
DRIVES

IOMEGA ... 1 year

5116	Bernoulli II Single 44 Meg Internal	995.
5117	Bernoulli II Dual 44 Meg External	1969.
5113	44 Meg Cartridge Tripak *(5¼")*	249.
2500	PC2B Controller	229.
2503	PC4B Controller *(Microchannel)*	299.
7551	Bernoulli II Transportable 44 Meg	997.

Mountain Computer ... 2 years

2917	40-60 Meg Internal Tape Drive	259.
2916	40-60M Ext. Tape Drive *(w/power supply)*	489.
5500	80-152M Int. Tape Drive	629.
5502	83-152M Ext. Tape Drive	799.
5190	DC2000 Pre-formatted Cartridges ea.	35.
6153	DC2120 Tape Cartridge *(5 pack)*	135.



Practical Peripherals ... 5 years
8132 *PM2400 Pocket Modem*—2400bps performance in a tiny package. Attaches to and draws power directly from the RS232 serial port. Great for laptops, desktops, or Macs .. $99.

Pacific Rim ... 1 year

5011	360k External	179.
7727	360k External for PS/2	189.
5009	1.2 Meg External	209.
5010	1.2 Meg External *(for PS/2's)*	215.
6602	1.44 External *(for PC/XT/AT)*	239.

Plus Development ... 2 years

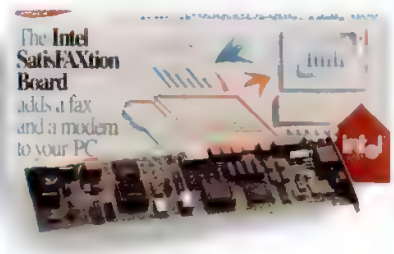
6425	Hardcard II 40 Meg *(19 ms)*	399.
6424	Hardcard II 80 Meg *(19 ms)*	699.

Seagate ... 1 year

2285	20 Meg Int. Hard Drive ST225 *(w/controller and cables, 65 ms)*	255.
2286	30 Meg Int. Hard Drive ST238R *(w/controller and cables, 65 ms)*	269.
4554	40 Meg Int. HD ST251-1 (28 ms)	329.
7102	ST251-1 Model 25 *(w/controller)*	339.
7103	ST251-1 Model 30 *(w/controller)*	339.
7099	ST251-1 PC/XT *(w/controller)*	329.
7154	ST138R-1 Model 25 *(w/controller)*	359.
7155	ST138R-1 Model 30 *(w/controller)*	359.
7153	ST138R-1 PC/XT *(w/controller)*	359.

TEAC ... 1 year

4950	360k Drive *(for PC)*	$79.
4951	720k Drive *(specify XT or AT, 3½")*	75.
4670	1.44 Meg Drive for PC/XT *(3½")*	89.
4326	1.44 Meg Drive for AT	109.
6951	1.2 Meg Drive for AT	99.
6952	1.2 Meg Drive for PC/XT	99.



Intel ... 5 years
7782 *SatisFAXtion*—Send and receive faxes from within most applications using the print command. Built-in 2400 bps MNP modem standard. Includes coupons for free PC Tools and Fax-It software ..... $399.

Pacific Data Products ... lifetime
7158 *PacificPage Personal Edition 4.0*—New and improved PostScript emulation for your HP LaserJet IIP, IID or III. Faster, superb font quality. Minimum 1.5M printer memory required ..... $379.

DISKS

Maxell ... lifetime

2789	5¼" MD2-D 360k Disks *(Qty. 10)*	12.
2790	5¼" MD2-HD 1.2Mb Disks *(Qty. 10)*	19.
2792	3½" DS/DD 720k Diskettes *(Qty. 10)*	14.
2793	3½" DS/HD 1.44Mb Diskettes *(Qty. 10)*	27.

Sony ... lifetime

3291	5¼" DS/DD 360k Disks *(Qty. 10)*	10.
3292	5¼" DS/HD 1.2Mb Disks *(Qty. 10)*	19.
3297	3½" DS/DD 720k Diskettes *(Qty. 10)*	13.
3298	3½" DS/HD 1.44Mb Diskettes *(Qty. 10)*	22.
6659	QD 2000 Tape Cartridge	19.

MEMORY

6556	256k DRAMs *(100 ns, set of 9)*	29.
5510	1 Meg x 9 SIMMs *(80 nanosecond)*	79.
5746	1 Meg Chips *(80 ns, set of 9)*	69.

OUR POLICY

- We accept VISA and MASTERCARD only.
- No surcharge added for credit card orders.
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- To order, call us Monday through Friday 8:00 AM to 1:00 AM, or Saturday 9:00 AM to 5:30 PM. You can call our business offices at 603/446-3383 Monday through Friday 9:00 AM to 5:30 PM.

Reflection Technology ... 1 year
7127 *Private Eye*—A large screen in a small box. A tiny virtual display which offers a full-size, 12" IBM CGA auxiliary screen to PCs & laptops. View privately in planes or meetings. Brighter than LCDs ..... $499.

SHIPPING

Note: Accounts on net terms pay actual shipping.

Continental US:

- For heavy hardware items such as printers, monitors, Bernoulli Boxes, etc. pay actual charges. Call for UPS 2nd-Day & Next-Day-Air.
- For all other items, add $3 per order to cover UPS Shipping. For such items, we automatically use Airborne Express at no extra charge if you are more than 2 days from us by UPS ground.

Hawaii:

- For monitors, printers, Bernoulli Boxes, computers, hard drives, and power backups, actual UPS Blue charge will be added. For all other items, add $3 per order.

Alaska and outside Continental US:

- Call 603/446-7721 for information.

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PC Chronicles.

Call me a lyre.
(Or, how we wrote the book on PC mail order.)

Truth tends to be stranger than fiction in the telltail town of Marlow, NH (pop. 564). That's why you'll often find the local color gathered 'round the ancient sage as he recounts in vivid detail how our forest glade was transformed into a PC paradise.

For, in days of yore, buying software and peripherals by mail was a perilous task, fraught with danger and uncertainty. Only those well versed in the black arts dared risk such unpredictable delivery and uncertain compatibility.

Then one day the enlightened Order of the Connection appeared majestically on the scene, bringing the classic virtues of toll-free tech support, prompt shipping, and way-under-retail prices to the brave new world of the IBM PC. Since that glorious day our humble home has served as a beacon of light to noble users in cottages, condos, and corporations throughout America.

That'll be the day.

It's not every day of the week you get offered your very own 1991 PC Connection Calendar. This very timely offer includes 13 classic illustrations of our legendary mascots, all your favorite holidays, and fascinating historical facts about the fiefdom of Marlow, NH. This wondrous wall calendar is free to everyone who places an order of $750 or more between now and February 28.

Mark time with the PC Connection Calendar featuring our very own day-tripping mascots. Offer not available to accounts on net terms. One per customer.

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SPREADSHEET GRAPHICS: SUMMARY OF FEATURES

	Lotus 1-2-3, Release 2.2	Microsoft Excel	Quattro Pro	Wingz	Lotus 1-2-3, Release 3.1	Lotus 1-2-3/G
DEVICE SUPPORT						
Printers:						
Hewlett-Packard LaserJet	■	■	■	■	■	■
Hewlett-Packard DeskJet	■	■	■	■	■	■
PostScript	■	■	■	■	■	■
Color PostScript	□	■	■	■	□	■
Hewlett-Packard PaintJet	■	■	■	■	■	■
Plotters	■	■	■	■	■	■
Film recorders	□	■	□	■	□	□
Export file formats:						
CGM (Computer Graphic Metafile)	□	□	□	□	■	□
.WMF (Windows Metafile)	□	■	□	■	□	■
.EPS (Encapsulated PostScript)	□	□	■	□	□	□
HPGL	□	■	□	□	□	□
.PIC (Lotus)	■	□	■	□	■	□
.DXF (AutoCAD)	□	□	□	□	□	□

□—Editor's Choice ■—Yes □—No

Paste Special command. And getting the right series split for a combination graph can sometimes require you to edit one or more of the complex Series formulas that *Excel* uses to record the parameters of your chart—an onerous process.

FLIES IN THE OINTMENT

For all its intelligence, *Excel* is a little stupid in a couple of respects. It doesn't let you stagger unwieldy *x*-axis labels, for example; it just breaks them, with no thought of proper hyphenation. Equally irritating is the program's insistence on displaying *x*-axis labels immediately below the axis, even when the *y*-axis extends into negative territory. You can avoid having the labels obliterate your data by lowering the axis to the bottom of the graph (instead of having it cross at 0, or suppressing the *x*-axis display), but the program should be smart enough to save you the trouble.

If you want to print your charts alongside worksheet numbers, you should be aware that only way to do this with *Excel* is to assemble its graphs and worksheets in a word processing program. In the *Windows* environment, the clipboard and export file standards make this a snap, and you can even hot-link your worksheets, using DDE, for rapid updates as information changes. But if you don't already have a *Windows* word processor, you may prefer one of the other spreadsheets that lets you print graphs on the same page as your worksheets.

Having gone for three years now without a major upgrade, *Excel* has definitely acquired a few competitive vulnerabilities. It lacks the three-dimensional charts in *Wingz*, *1-2-3/G*, and the soon-to-be-released *Quattro Pro* 2.0, and it's missing the freehand drawing capabilities that *Quattro Pro* and *Wingz* provide. But for everyday business charting, it's still the easiest to use and the most intelligent spreadsheet program you can buy.

***Quattro Pro*'s graphs are some of the snappiest you'll find, and their default patterns work well for black-and-white output. The default color choices can produce illegible labels, but you can change the colors easily using simple menu commands.**

Quattro Pro

Borland's *Quattro Pro* offers the strongest graphics of any character-mode spreadsheet. It gives you 11 basic chart types, a myriad of customizing options, 11 scalable fonts (in addition to your printer's own fonts), a good set of drawing tools, and a modest but useful clip-art library. Best of all, it runs quite well on any machine that can muster 512K of RAM and a hard disk.

Creating graphs in *Quattro Pro* is basically like creating graphs in *Lotus 1-2-3*, Release 2.2. You can chart any number of data points in up to six data

INCLUDED FOR COMPARISON		
Lotus Freelance Plus	Harvard Graphics	Lotus Graphwriter
■	■	■
■	■	□
■	■	■
■	■	□
■	■	■
■	■	■
■	■	■
■	■	■
□	□	□
■	■	■
■	■	■
□	□	□
■	□	□
ENDS		

FACT FILE
EDITOR'S CHOICE

***Quattro Pro*, Version 1.0**
Borland International, 1800 Green Hills Rd., Scotts Valley, CA 95067; (408) 438-5300.
List Price: $495.
Requires: IBM XT, AT, or compatible; 512K RAM; hard disk; DOS 2.0 or later.
In Short: A good range of charting options, excellent font support, and full-featured annotation capabilities give *Quattro Pro* extraordinary capabilities. Though its rather complex menu trees make it less easy to use than some graphically-based packages, it produces some great-looking graphs.

CIRCLE 424 ON READER SERVICE CARD

series, which you assign using menu commands. (You can also specify a rectangular block to graph several series in a single operation.) As in *1-2-3*, you can store named graphs along with worksheet data or save them separately in .PIC files (*Quattro Pro* also lets you save them in .EPS format for incorporation into desktop-published documents and presentations). And you can view the current graph at any time by pressing the F10 key.

SMART LOOKS

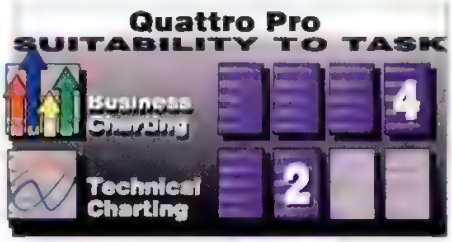
But that's where the similarities end. To supplement the five basic graph types available in *1-2-3*, *Quattro Pro* offers horizontal bar charts, column charts (pie charts scrunched into vertical bars), area charts, high-low-open-close, and combination line/bar charts. It even offers a "text chart" option that gives you a blank slate for creating bullet lists and freehand drawings.

Quattro Pro's graphs are also far better-looking than *1-2-3*'s. Bars are drawn in three-dimensional perspective, pies appear as three-dimensional disks, text is large and legible, and data series are distinguished by pattern as well as by color—which means you don't have to modify the settings to get decent-looking black-and-white printouts. All these defaults—including the 3-D perspective, the distribution of space on bar graphs, and the standard arrangement of colors and fill patterns—can be modified, either temporarily or permanently.

Quattro Pro also lets you display and print any number of graphs alongside worksheet data. As with *Allways*, you just define a worksheet block and name the graph that goes into it. The aspect ratio is maintained by default, but you do have the option of stretching the graph to fill the space. Graphs in *Quattro Pro* can reference data in external worksheets, just as any worksheet formula can; this makes it possible to graph consolidated figures without creating a separate consolidation worksheet.

TEXT AND DRAWINGS

Quattro Pro offers the same basic set of label options as *1-2-3*: two main title lines, *x*- and *y*-axis titles, and interior data labels. But it's far better with the text itself. You can choose from three Bitstream fonts (Swiss, Dutch, and Courier) and eight Hershey fonts, all available in sizes from 6 through 72 points, and you can augment this supply with additional Bitstream fonts. You can also use whatever fonts your printer happens to provide: The program supports 37 PostScript typefaces and the entire line of HP LaserJet cartridges.



Beyond the Graph menu lies the Annotator—a miniature drawing package that lets you adorn your charts with additional text, arrows, boxes, and clip-art images. You'll find the usual range of tools in a small toolbox, and Borland supplies 35 clip-art symbols with the spreadsheet, including such useful items as bullets, arrowheads, and money symbols. Unfortunately, these are in a proprietary .CLP format, but you can buy additional images—and a CGM-to-.CLP translator—from Marketing Graphics, a Virginia-based clip-art vendor.

The Annotator also allows you to create ordinary text slides, which lets you push *Quattro Pro* beyond single charts to full presentations. You can even create a screen show by stringing together graphs with timed or key-driven transitions. The results are not by any means equivalent to a full-fledged presentation graphics package. For instance, while the text tool gives you access to *Quattro Pro*'s entire font library, including seven bullet styles, you'll have no word-wrap or multico-

***Quattro Pro* requires you to reset graph parameters before you start creating a new graph. Unfortunately, the reset command is located four levels deep in a very complex menu tree.**

Complaints aside, *Quattro Pro* offers some of the most powerful charting and best-quality output you'll see in a spreadsheet today.

lumn capability to speed you along and ensure consistency in your word charts. But these features are helpful for quick presentations.

LESS THAN GRAPHICAL

On the short side of the ledger, *Quattro Pro* is missing a few desirable graph types. It won't, for example, let you plot multiple data series in three-dimensional perspective (one series behind the next along a third axis), and it won't combine a high-low-open-close plot with a bar or line chart.

Also, though *Quattro Pro* does some amazing things for a character-based package, it's simply not as easy to use as its graphically-based competitors. Its slash-command approach to setting options (specifying titles, colors, fill patterns, axis-scaling, secondary axes, bar widths, and so on) makes for a very bulky menu tree. Though you can select a few things (the main title, the plot area, and the legend) directly in graphics mode, to get to the series customizing options such as colors and patterns you have to go through the menu tree. And *Quattro Pro*'s implementation of the chart gallery is a weak imitation of *Excel*'s and *1-2-3/G*'s; it presents only the basic types, making you wander through the menu tree to select common options. *Quattro Pro* badly needs something comparable to *1-2-3* Release 2.2's settings sheet to help you keep track of what options you've already chosen.

Complaints aside, *Quattro Pro* offers some of the most powerful charting and best-quality output you'll see in a spreadsheet today. And *Quattro Pro* 2.0—which should be on dealers' shelves not long after this article appears—will be even better graphically, offering three-dimensional bar, step, line (or ribbon) and area graphs, as well as the ability to import CGM-format clip-art directly and export graphics in .PCX or .EPS formats suitable for slide production. It will even let you create "hot buttons" that execute macros, which you can use to build branching on-screen slide presentations similar to the "hyperlinks" offered by *Harvard Graphics* 2.3. If you need excellent graphics and are reluctant to make the move to *Windows* or Presentation Manager, this is the place to go.

Wingz

Informix Software's *Wingz* has built a reputation in the Macintosh market as a graphics powerhouse, and the PC version of *Wingz* offers an unparalleled range of charting options, particularly in the technical area. Engineers and meteorologists, for example, will appreciate the program's polar, contour, surface, and wireframe graphs, as well as the options for se-

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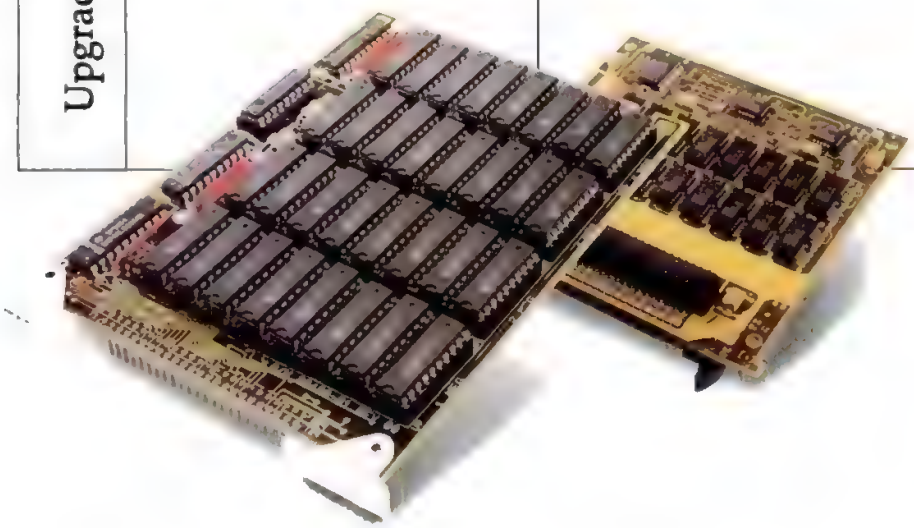

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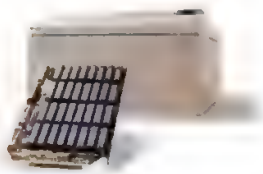

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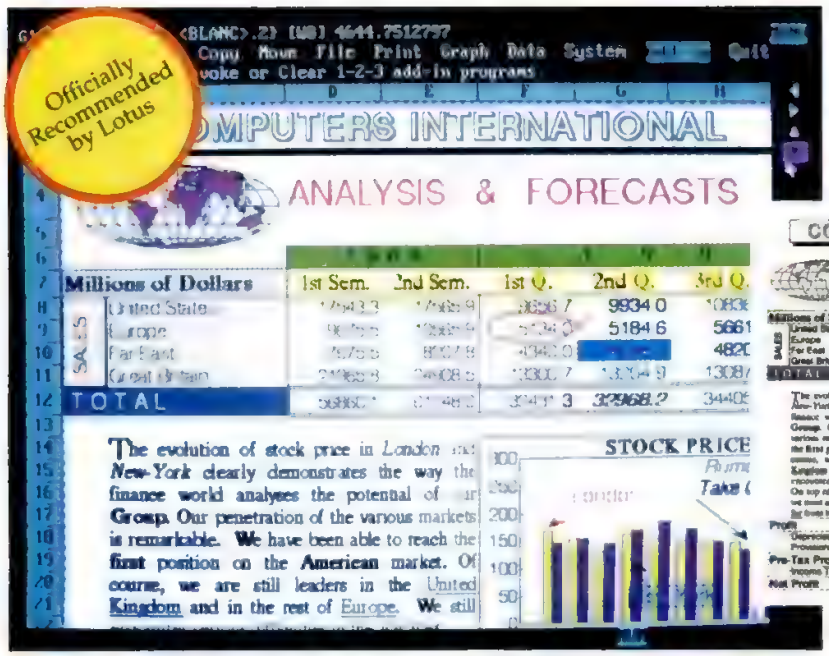

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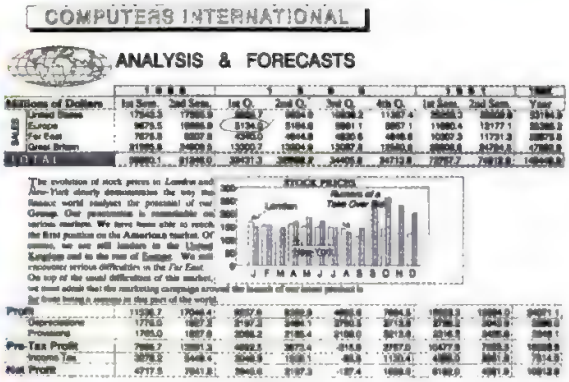

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PC PUBLISHING IMPRESS is compatible with Allways files. So you can improve them, or simply work on them without having to toggle to text mode. IMPRESS works with 1-2-3 Rel 2.0, 2.01, & 2.2.

Technical Requirements

IMPRESS works with: *1-2-3 release 2.0, 2.01 or 2.2, DOS 2.0 or later, CGA, EGA, VGA or Hercules (No color in CGA). Supports all graphics printers that work with 1-2-3: including Dot Matrix, Desk Jet, Laser printers (Hewlett Packard, Postscript, etc. . .), Color printers. IMPRESS occupies 93k RAM above 1-2-3 (uses EMS if available). Many Bitstream Fonts included with package. 1-2-3 is a registered trademark of Lotus Development Corp.*

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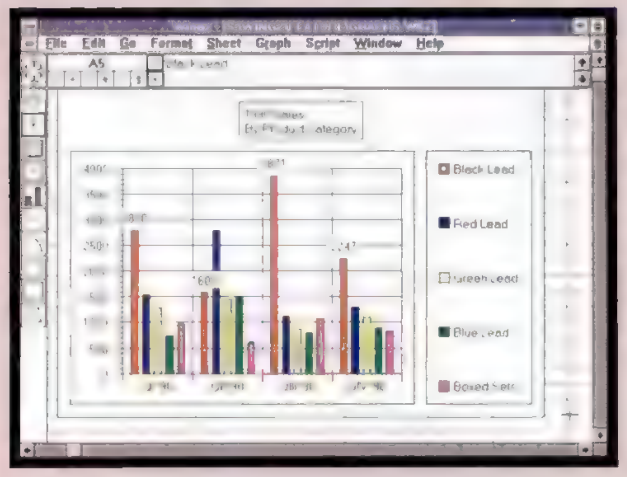

***Wingz* offers unparalleled flexibility in its graphing options. You can apply data labels, for instance, to the base and midpoints of bars, as well as above them, and you can customize any series simply by clicking on its legend.**

lectable-base exponential scaling.

The selection of commonplace business graphs isn't bad, either. In addition to the standard two-dimensional bar, line, pie, scatter, area, and hi-lo-open-close charts, *Wingz* offers an assortment of three-dimensional chart types. These are not true *x,y,z* graphs, but they allow you to plot multiple data series behind one another instead of in two-dimensional clusters. Customizing commands allow you to rotate and tilt these graphs to achieve whatever perspective best suits you and even to stretch or compress the graphs along the series, or category, axis.

Unlike the other programs reviewed here, *Wingz* will also let you compare multiple data series in pie charts. You can have each member of a group of pies sized identically, apportion their sizes according to the aggregate value of each series, or apportion their sizes according to any other predefined weighting scheme. Unfortunately, *Wingz* does not offer an *Excel*-style charting gallery—you must pick your chart types from a plain-text menu.

DRAWING BOARD

Aside from the unusual breadth of its charting options, *Wingz* distinguishes itself from its graphical competitors *Excel* and *1-2-3/G* by planting graphs directly on your worksheet rather than in separate windows and files. You can view the *Wingz* worksheet as a kind of drawing board on which you can put various kinds of objects in addition to traditional spreadsheet matter. Graphs are one such object—others include text fields of any size (complete with word wrap and indentation control), command buttons linked to *Wingz* macros, and freehand drawings. The objects are opaque and can be layered as you please—"Bring to Front" and "Send to Back" commands let you reorder the layers. The worksheet itself remains at the bottom of the stack; to see hidden worksheet data, you can use menu commands to suppress the display of overlapping objects.

To create a graph, you first select the numbers (and associated text) you wish to plot. Then you click the graph tool in the icon palette, drag the mouse over the area where you want your graph to appear, and release the mouse button. *Wingz* draws a bar graph by default, complete with leg-

Wingz
Informix Software Inc., 4100 Bohannon Dr., Menlo Park, CA 94025; (415) 926-6300.
List Price: $495 (includes both *Windows* and OS/2 versions).
Requires: IBM AT or compatible, 1MB RAM, hard disk, mouse, DOS 3.2 or later, *Microsoft Windows* 3.0. EGA or VGA graphics adapter recommended
In Short: *Wingz*'s powerhouse graphics capabilities, which include true 3-D charting, a range of technical charting and scaling options, presentation-quality color support, and flexible document formatting, are tempered by awkward design choices and some annoying bugs.

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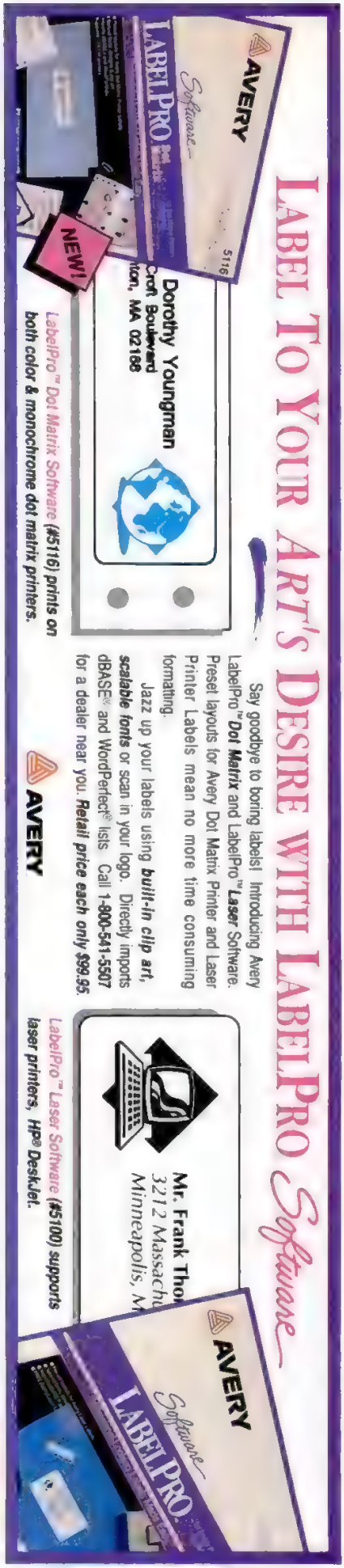


CIRCLE 129 ON READER SERVICE CARD

CHARTING IN BULK

by Ronni and Harry Geist

The business arena offers numerous occasions in which a sequence of charts must be redrawn with updated information. You can do this quite easily by using the graphics capabilities of your spreadsheet, but if you need more charting options than it has, you face the unpleasant prospect of importing spreadsheet data repeatedly into a graphics package to produce charts.

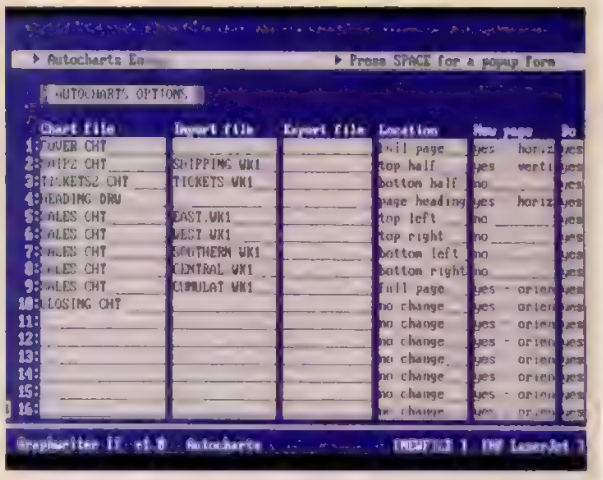
A number of presentation graphics packages, notably Ashton-Tate's *Applause II*, Software Publishing's *Harvard Graphics*, and Lotus's own *Freelance Plus*, let you link charts directly to *1-2-3* spreadsheets. Once a link is established, any changes you make in the spreadsheet data will be reflected in the linked graphs the next time you start the graphics program. But even with linking, updating dozens or hundreds of charts one chart at a time can be very time-consuming.

What's really needed is a package that can automatically generate a series of charts with the revised data. And that's just what *Graphwriter II*, from Lotus Development Corp., is designed to do. Using the familiar Lotus screen interface, *Graphwriter* links multiple graphs directly to your spreadsheets and then lets you print up to 100 charts in a single batch operation.

DOING IT AUTOMATICALLY

Graphwriter's links (which it calls Datalinks), are straightforward in concept. Just define your charting parameters (the chart type, the fonts, and the location of headings and comments), designate the spreadsheet to which the chart will be linked, and select the data elements to be imported into the chart. *Graphwriter* lets you use named ranges from your spreadsheet, but you can also display the spreadsheet from within *Graphwriter*, highlighting ranges to be imported. This latter option is a considerable convenience: You can take a heading from here, a row or column from there, and graph them as required.

Once you've defined the individual charts, you can use *Graphwriter*'s Autochart feature to designate which charts should be printed, and how. You can print one, two, or four charts to a page, and you can specify the size and location for each chart. You can print graphs in either landscape or portrait orientation; all pages needn't have the same orientation. Once your Autochart file is set up, you can print the charts from the DOS prompt, without entering *Graphwriter*.



Lotus *Graphwriter II*'s Autochart function makes it easy to print updated charts in bulk, in varying page locations and orientations. Note that you can link multiple worksheets to the same chart design for consistency's sake; in this case, SALES.CHT is linked to five different worksheets.

The power of *Graphwriter*'s Autochart capabilities is most evident when you need to present data from a number of similar spreadsheets in a single, consistent chart format. For instance, suppose you have created a bar chart linked to a spreadsheet containing Eastern sales data. *Graphwriter* lets you easily produce additional charts from the same layout using spreadsheets with Western or Southern sales data instead. You wouldn't need to relink the chart each time; you'd simply override the data link to the Eastern sales region's spreadsheet, substituting the spreadsheet for the appropriate region instead.

GOLDEN OLDIE

Last updated in 1988, *Graphwriter* shows its age. Its charting options are as robust as you'd like. It produces horizontal, vertical, stacked, and clustered bar charts; pie, line, scatter, and area charts; and also combination (bar-line), hi-lo-open-close, and the less common text, Gantt, and organization charts—as much as you need for most business purposes.

Yet the program lacks many of the flourishes we've come to expect, especially in a package costing $495. Its character-based interface looks and feels dated, and such niceties as clip art, freehand drawing tools, customizable color palettes, and high-quality third-party fonts are conspicuous in their absence. Lotus recommends that you export your *Graphwriter* charts to *Freelance Plus* for embellishment, but this inconvenient and expensive route to snappy graphics defeats the purpose of having *Graphwriter* in the first place, which is to update many charts rapidly.

Graphwriter also has some idiosyncrasies that would not likely be tolerated in a more recent release. For example, when the printer runs out of paper while Autocharting a series of graphs, the program simply terminates without warning, returning you to the DOS prompt. And the poor kerning and awkward spacing of *Graphwriter*'s proprietary typefaces (it doesn't support Bitstream fonts, except with certain types of film recorders) detract from the appearance of its printed output.

As it stands today, *Graphwriter* is a good product for a limited purpose. If you create dozens of charts on a routine basis and aren't too concerned about producing the snazziest output, *Graphwriter II* fits the bill, though at a rather high cost. Yet it's unfortunate that you have to give up so much to get the power of automated charting. Perhaps Lotus should consider adding this feature to *Freelance Plus*.

Lotus Graphwriter II

Lotus Development Corp., 55 Cambridge Pkwy., Cambridge, MA 02142; (617) 577-8500.

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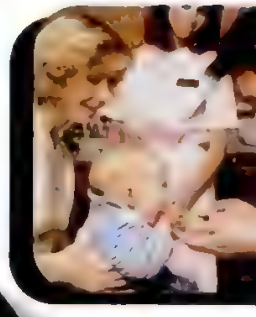

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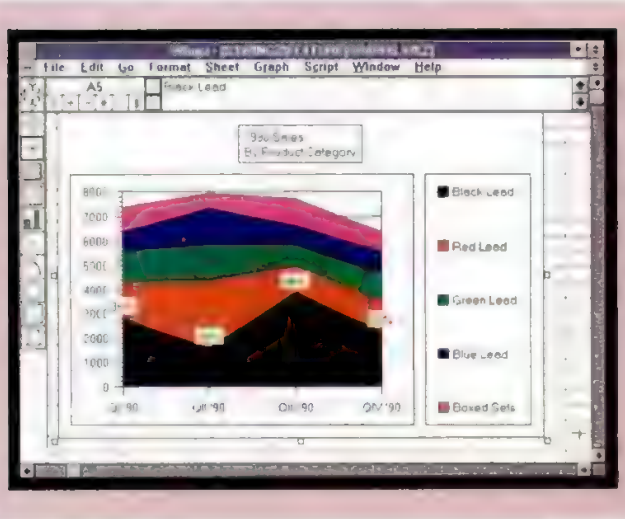
end. If the upper-left corner of the selected range contains text, that text is automatically used as a graph title.

This drawing-board approach has its advantages and disadvantages. On the plus side, it simplifies the creation of compound documents showing both charts and numbers, and it lets you add floating text and other adornments easily. But unless you design your spreadsheet from the very start with space for graphics in mind, you may find yourself doing a lot of awkward scrolling just to find homes for your charts. It would be far better to have the option of housing your graphics in their own windows and files. This would eliminate the need to allocate worksheet space for every graph and would make charts easier to export, as well.



Wingz offers a "percentage" option for marking data points: It reports each point's value as a percentage of the highest tick on the *y*-axis—not as a percentage of the total—a potentially misleading situation.

ANNOYANCES

Wingz, like *Excel*, lets you keep multiple spreadsheets open in memory. But you can't select a set of numbers in one worksheet and plot them in another. Nor can you open a second window on the first worksheet and plot them there; each window's selection is independent of the other's. For that matter, you can't plot any external worksheet data at all. As a result, to compare data series from separate models, you need to assemble them into a single worksheet first, using worksheet-linking formulas.

Printing charts with data is easy, but printing charts by themselves is a pain. First you must select the underlying block of worksheet cells (you can't simply select the graph) and define that as your "report range." To do that, you have to use a Show command to suppress the graphic display. Then, to prevent the cell grid from peeking out from under your chart, you must use another Show command to suppress the worksheet display. All of this is more time-consuming than it should be.

Unlike *Excel* and *1-2-3/G*, *Wingz* does not parse your graph range according to its shape. Each of its graph types has a particular default parsing scheme, and if you don't agree with the way the program divides your data into series and points, you must delete the graph, use a menu command to override the defaults, and redraw. Finally, on top of all these other annoyances, *Wingz* seems to have serious problems printing to an HP LaserJet. Boxes that look fine on screen, for instance, show rather ugly discontinuities on paper.

In short, *Wingz* is a mixed bag. It provides technical graphs not available in any other spreadsheet, and it offers unusual flexibility for fine-tuning the appearance and presentation of your graphs. But it's an awkward tool to use for many everyday business charting tasks. In spite of its design savvy, until Informix refines the basics, you may be better off with another product. ■

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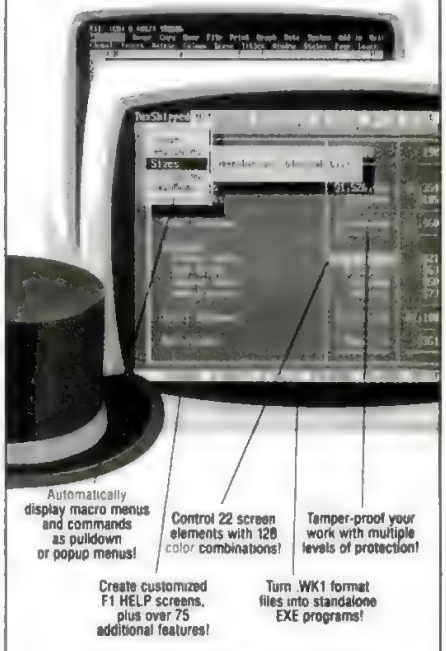
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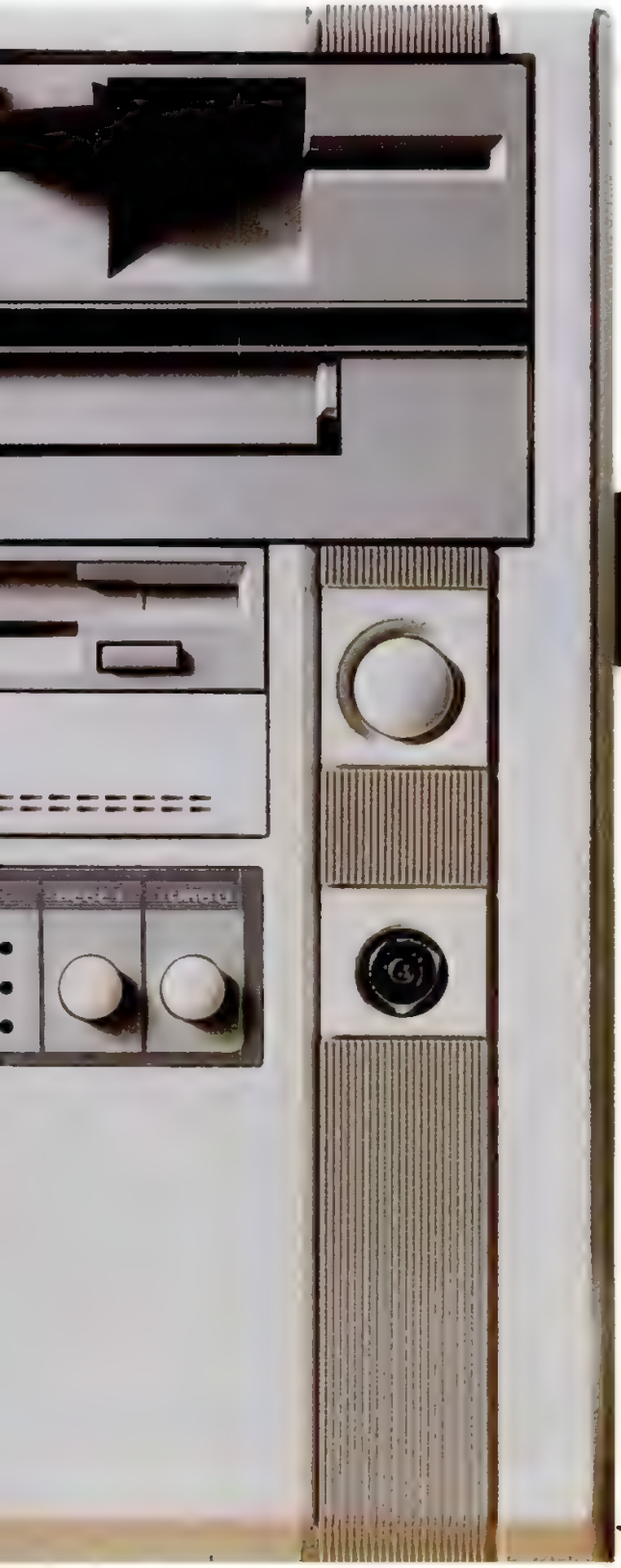

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- 128K Cache upgrade board with Weitek co-processor socket**
- Factory Installed RAM Upgrades
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Hard Drives: MB/MS	89/19	125/19	170/15	320/16	640/15
Mono	$599	$770	$1020	$1870	$2730
VGA-Mono	$758	$929	$1179	$2029	$2889
VGA-Color	$944	$1115	$1365	$2215	$3075
SVGA-Color*	$1079	$1250	$1500	$2350	$3210

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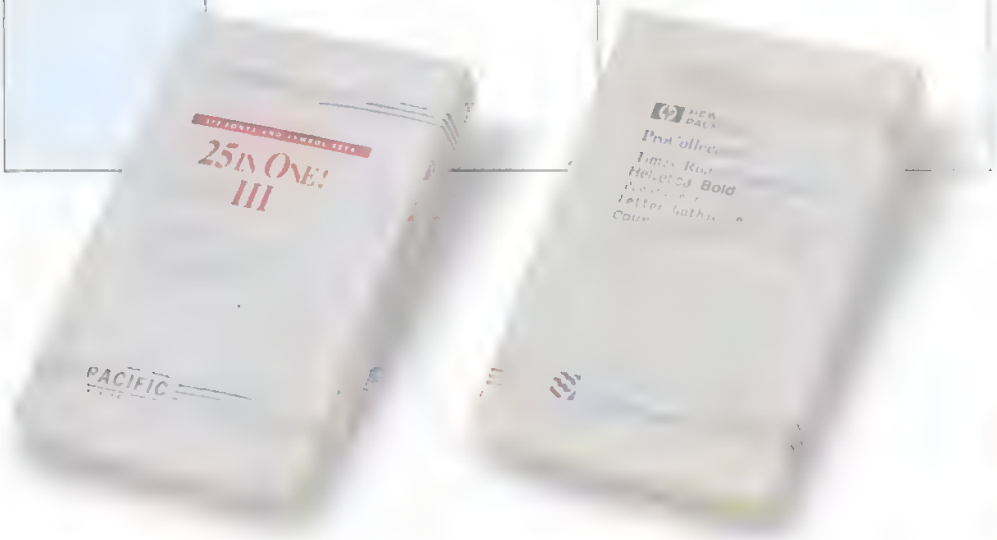

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9,600-BPS MODEMS

Breaking the Speed Barrier

PC LAN Labs tests seven rapid-fire modems complying with V.32, V.42, and V.42bis standards. They get file-transfer chores done in a hurry while correcting errors and compressing files on the fly.

by Mike Byrd

Like a teenager with a dragster, the modem industry constantly strives to squeeze the last bit of speed out of its hardware. But the laws of physics and economics limit the maximum electrical signaling speed over dial-up telephone lines, just as they limit the speed of a car on the quarter-mile track. Dreams of shorter elapsed times hinge on turbocharging existing technology. The latest modem turbochargers center on new V.32, V.42, and V.42bis error-checking and data-compression protocols, yielding throughput rates of 9,600, 19,600, and even 38,400 bits per second over dial-up telephone lines.

Do you need all this speed? If your organization must transfer large files over telephone lines, these modems can save time and money. But we found that total compatibility is still more a goal than a reality. For the time being, you should either buy all of your V.42bis modems from the same vendor or test for compatibility before you buy. Also, find out about upgrade information from your vendor if you buy your modem before next spring; additional standards may be in place by then.

This review looks at the hottest modems you can put on dial-up telephone lines, all complying with the V.32, V.42, and V.42bis standards. We evaluate seven high-speed modems from ATI Technologies, Hayes Microcomputer Products, Microcom, Multi-Tech Systems, Telebit Corp., Universal Data Systems, and U.S. Robotics. Although these modems carry retail price tags ranging from $699 to $1,345, quantity discounts and mail-order prices are usually available.

ESTABLISHING COMMUNICATION

Since phone lines are designed to carry sounds, they're not suitable for conveying the digital data signals in your computer. Phone signals pass through countless transformers and switching stations while they travel from origin to destination; digital signals would simply get lost en route. A modem converts digital bits from your PC to analog tones more suitable for telephone lines. The receiving modem then converts the tones back to digital bits for subsequent processing by a PC.

When you make a voice call, the person at the receiving end usually answers, "Hello." You respond with your name, and the conversation begins. Modems work much the same way, *handshaking* to establish communications. When your modem calls another, the second modem responds with a set of answer tones. The two modems then negotiate to find out how to communicate with each other. The underlying procedure, called a *renegotiation protocol*, helps the modems determine which signaling, error-correction, and data compression protocols to follow.

First they go through a series of questions and answers, establishing first what kinds of modems they are and then what transfer rate they are going to use. Usually this handshake assumes the fastest send rate, negotiating down to the highest common rate. Noise on the telephone line may lower the signaling rate further.

Next, the modems negotiate whether a hardware error-correction protocol is available, starting with the highest protocol level for error correction and data compression. When negotiations are complete, the modems normally transfer control to the PC software for processing.

MODEM TALK

Modems typically need some instructions concerning what you want to do. The computer sends a set of characters called a *configuration string* to the modem and tells it how to communicate with your computer, your phone line, and other modems. You usually use the Hayes Standard AT Command Set or a derivative to tailor your modem's configuration; you can even send Hayes commands directly to your modem to place and answer phone calls. But these commands stop at making the connection; you need more software to perform such activities as transferring files. Once connected, your communications software handles those chores.

Even though the Hayes Command Set is a de facto standard, compatibility remains a problem. A modem isn't necessarily compatible simply because it dials a number in response to the ATDT command; various companies implement many other important commands differently (for more information see "Inside Talk: 2,400-bps PS/2 Modems," *PC Magazine*, July 1989). You might need to consult both the modem vendor and the vendor of your communications software to get all of your modem's features correctly initialized.

As PC hardware and software systems evolved, files got bigger and modems were used for increasingly complex tasks.

ASYNCHRONOUS VS. SYNCHRONOUS

Most modems offer a range of transmission *modes* or connections to a variety of environments. PC-to-PC modem transmissions generally use the *asynchronous* mode. In asynchronous transmissions, the modem sends each character independently, with certain bits announcing the arrival and completion of the character.

The *synchronous* mode provides connectivity from PCs or terminals to mainframe computers. In synchronous format, transmit and receive clocks at both ends of the link control the precise timing of the characters sent in a block. All the hardware in the link (mainframe port, modems, and PC or terminal) must operate using a single clocking source.

Several synchronous protocols help format and transmit data. These include Synchronous Data Link Control (SDLC), High-level Data Link Control (HDLC), and Binary Synchronous Control (BISYNC). These protocols format the data into blocks, add control information, and check this information to provide error control.

THE NEED FOR SPEED

PC users deserve much of the credit for driving the improvements in the technology of modems for dial-up lines. Since the telephone companies and information services bill by the minute, they have no incentive to provide fast hardware. Ten years ago in the United States, roughly when IBM was making plans to introduce its first PC, the Bell Operating Company standards for dial-up telephone lines (Bell 103 and Bell 212) described 300- and 1,200-baud signaling speeds. Modems for these speeds carried prices of over $400 in less-inflated dollars.

As PC hardware and software systems evolved, files got bigger and modems were used for increasingly complex tasks, such as remote control of networked PCs. Four years ago, Rockwell International Corp. and other manufacturers made chip sets available for modems following the international V.22bis standards. The price of these modems is well under $300 today.

As PC users moved an ever-growing volume of data through modems, they demanded even higher throughput rates. Hayes Microcomputer Products, Microcom, and U.S. Robotics soon rose to the challenge by offering faster modems using proprietary transfer protocols. These worked their high-speed magic when connected with like modems but regressed to the standard 2,400 and 1,200 bps when a modem from another manufacturer sat at the other end.

ENTER STANDARDS

The International Consultative Committee on Telephone and Telegraph (CCITT in French) established the V.32 standard to avert the creation of an electronic Tower of Babel by manufacturers with their proprietary standards (see the sidebar "The Modem Alphanumeric Jungle"). The V.32 standard describes how modems should

talk to each other using two-way signaling at 4,800 and 9,600 bps over dial-up telephone lines.

Unfortunately the V.32 standard did not provide a method for error control. Since V.32 signaling is more sensitive to noise and echoes on the telephone line than lower-speed protocols are, you need a hardware- or software-driven error-control scheme to retain accuracy.

Microcom developed its own standard for asynchronous data error control, Microcom Network Protocol (MNP). Versions of MNP Classes 2, 3, and 4 are now available in a variety of modems and communications software packages. The software implements the error control protocols either in an application or in a modem's ROM, and the error checking operates independently of the signaling scheme used by the modem.

Last year, the CCITT issued a hardware-implemented asynchronous error-correction standard called V.42, which describes two error-correction schemes. The primary protocol is named Link Access Procedure for Modems (LAPM). The secondary or support protocol is functionally the same as MNP Class 4. If you want to communicate between two modems claiming to be V.42 compliant, you should connect them using the LAPM protocol. If you use one V.42-compliant modem and another compliant with MNP 4, you should employ the MNP 4 protocol. The LAPM method offers slightly better error recovery and reliability than MNP 4.

While the V.42 and MNP 4 protocols help maintain reliability, they don't improve throughput. After you increase the electrical signaling rate as much as possible and improve reliability, the next step in turbocharging involves file compression. When you compress files to remove redundant data or empty sections, the time it takes to send them across the telephone line decreases.

It's possible to compress files prior to transmission using *PKZIP* or other compression products, but the recipient must then decompress the file before it is usable. While compressing and decompressing files on the fly is easier for all involved, our tests at PC LAN Labs show that you get the best throughput by handling compression as a separate step before starting transmission.

DATA COMPRESSION PROTOCOLS

Microcom again led the industry by introducing the MNP Class 5 data-compression protocol. It soon became a feature in many modems and some application programs. Software supporting the MNP 5 protocol offers the ability to compress files to half their original size during transmission.

In late 1989, the CCITT issued the V.42bis standard (*bis* comes from the French word for revision), describing how to implement data compression on the fly in hardware. Using the Lempel-Ziv compression algorithm, the new V.42bis protocol potentially offers 35 percent greater data compression than MNP 5. For a 9,600-bps modem, this means a potential throughput of 38,400 bps for files with repeating patterns. For most file transfers, however, you can expect throughput of around 19,200 bps for files not previously compressed through other means (see the sidebar "Data Compression: Is It All It Claims?").

The V.42bis standard adapts to the data flow more quickly than MNP 5, turning data compression off and on as required by using an automatic feedback mechanism. This gives it an advantage over MNP 5 when transmitting previously compressed files, since the MNP 5 compression algorithm can cause compressed files to expand, reducing overall throughput. Consequently, its users often must manually disable the MNP 5 protocol when transmitting or receiving previously compressed files. V.42bis compression software works only with software that uses the V.42 error-correction protocol. All of the modems we found on the market with V.42bis also include MNP 5 as an alternative protocol.

It's important to understand that the V.32 standard primarily describes the electrical signaling scheme used over the telephone wire. In this way, V.32 resembles the V.22bis, Bell 103, and Bell 212 standards. Other standards, such as MNP, V.42, and V.42bis, describe actions taking place above the level of electrical signaling. So you can have modems using different combinations of signaling and error correction protocols. The modems in this review use V.32 signaling with V.42 error correction and V.42bis compression. Coincidentally, they also offer MNP error detection and file compression.

FUTURE STANDARDS

A modem using V.32 signaling with V.42bis error correction and compression is not the last modem you'll ever need. The CCITT is evaluating a revision to the V.32 standard, appropriately named V.32bis.

EDITOR'S CHOICE

• MultiModemV32 MT932EAB

If you're looking into purchasing one of the modems reviewed here, chances are you're buying for speed. A pair of V.32/V.42bis modems will pay for themselves in a few months by shortening the time you spend on long-distance calls. Thus, our Editor's Choice decision is strongly influenced by throughput, along with ease of use.

Some products, particularly the Hayes V-Series Ultra Smartmodem 9600, offer X.25 and a variety of other connection options. If you want those options, then the Hayes becomes the clear and comfortable choice as a high-quality product at a competitive price. Hayes has also made efforts to ensure compatibility with modems from different companies.

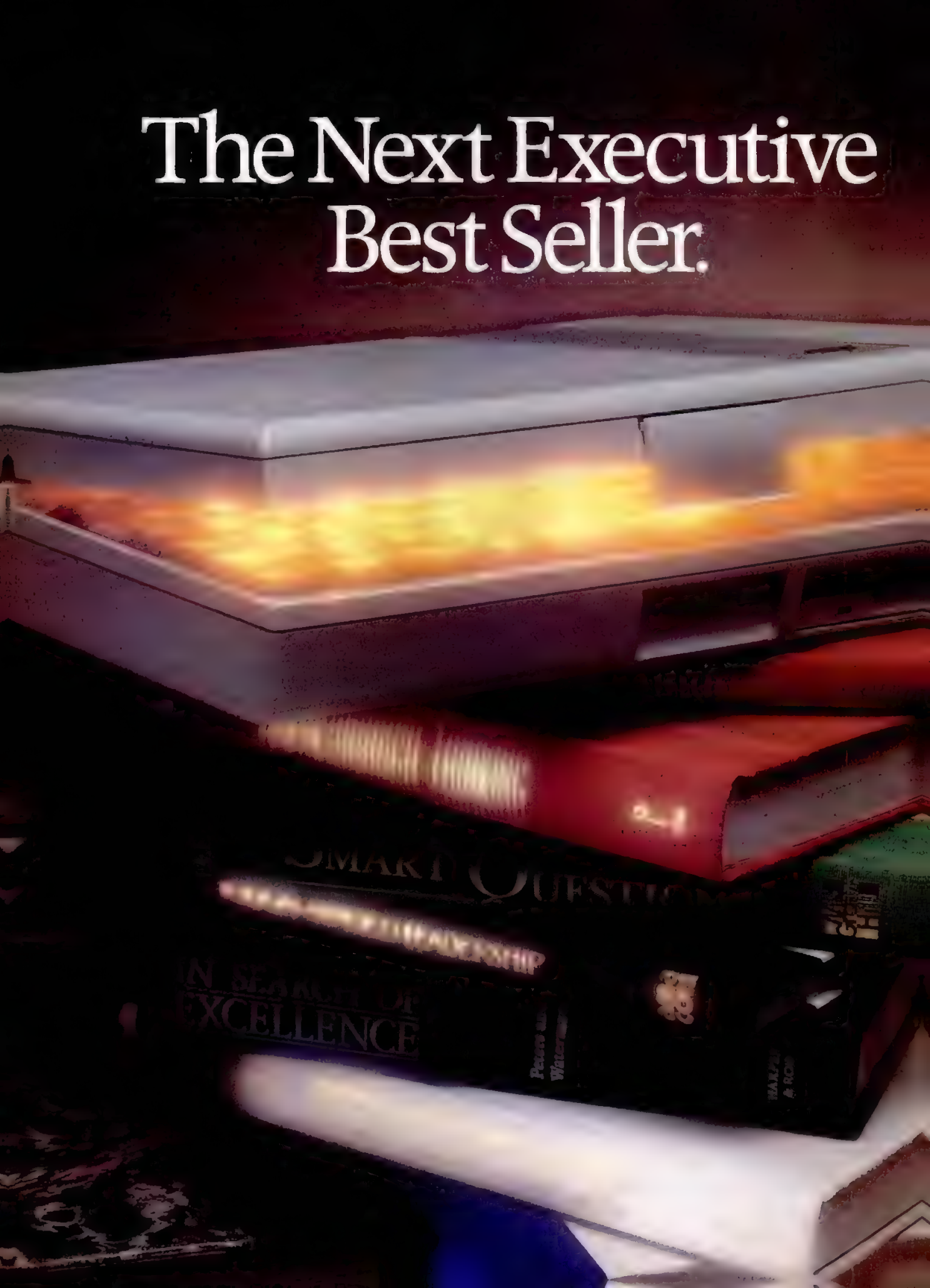
From the perspective of performance and ease of use, however, Multi-Tech Systems' MultiModemV32 MT932EAB wins our approval as Editor's Choice. This product usually moved data at least as fast as any other modem under a variety of conditions, and it's ready to work right out of the box.

The Microcom QX/4232hs deserves an honorable mention for its speed. The company holds a strong reputation as a leader in setting technical standards. Yet we generally prefer the Multi-Tech modem's ease of use.

The runner-up for reliability and stability is the ATI 9600etc/e. With its winning price tag of $699, the modem's full retail cost beats even the street price of competing products. The ATI 9600etc/e wasn't as compatible with other vendors' products as the Hayes, but when two ATI modems were talking together during our tests, they worked through tough conditions without an abort.

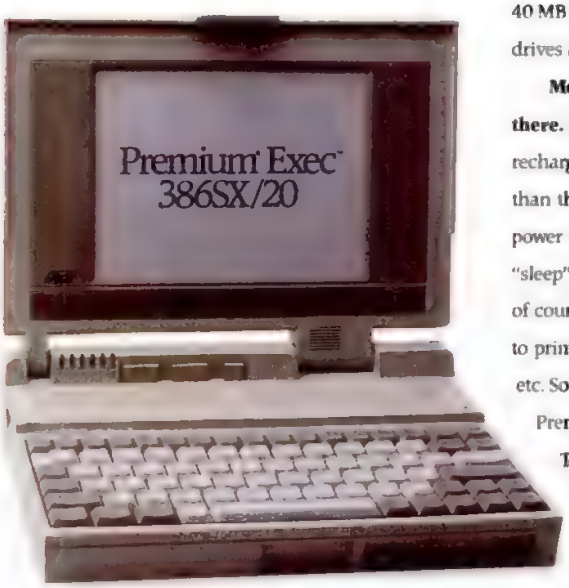
Meanwhile, new modems are evolving quickly, and all of the companies assure us that they will work out their compatibility differences within the next few months.

The Next Executive Best Seller.



A great executive best seller helps you succeed. And that's exactly the idea behind AST's new, 6.5 lb. Premium Exec notebook computers. Only 11.4" x 9" x 2.25," they're going to be the new source "book" for executives all over.

Premium Exec 386SX/20, starting at $2995. Premium Exec 286/12, starting at $2495. What makes one brand of notebook computers a best seller, while others gather dust on the shelves? In the case of Premium Exec notebooks from AST, it's style, power, upgradeability, a wealth of standard features and an extremely attractive price.



Start with the keyboard. Does it remind you of the one on your desktop computer? It should. Our keyboard has 82 keys, including function keys and dedicated word processing keys. Also, an inverted "T" cursor pad and standard key spacing mean you don't have to figure out a whole new way of typing. It'll keep your fingers happy through the most frustrating of spreadsheets.

Now turn on the power. You'll be greeted by a real-life VGA screen with 32 shades of gray. Its "paper white" display provides a bright clear image, designed to reduce eye strain. This new CCFT film supertwist display is the latest notebook display technology. It's brighter, offers higher contrast, uses less power and offers more reliability (up to three times longer than older EL technology) than ever before.

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CIRCLE 166 ON READER SERVICE CARD

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V.32bis adds 7,200-, 12,000-, and 14,400-bps transfer rates and a faster renegotiation protocol. V.32bis will be able to renegotiate the protocol in less than 100 milliseconds. The standard is expected to receive final approval from the CCITT by February 1991, and vendors should have V.32bis modems and upgrades available by spring or summer.

Note the recent availability of V.22bis modems with 2,400-bps signaling and V.42bis data compression. Most new 2,400-bps modems should be V.42bis compatible within a year.

The Integrated Services Digital Network (ISDN) also waits somewhere down the road for many of us. ISDN can convert analog telephone lines to digital lines, making them more compatible for computers transferring voice and graphics. Many telephone systems are converting to digital capability, but ISDN is not widespread and will not be fully implemented in this country—much less the rest of the world—for a long time. So don't wait for ISDN if you need high-speed wide-area connectivity now. Wait for a new V.32bis/V.42/V.42bis modem next spring; or if

THE MODEM ALPHANUMERIC JUNGLE

by Mike Byrd

If we didn't have standards, every modem company would use proprietary protocols and no one could communicate using another vendor's modem. Keeping track of the standards often means keeping track of the lingo, and in the world of telecommunications, the lingo translates into some fairly arcane groups of letters and numbers. Nevertheless, before you shop for modems, you need to familiarize yourself with the terminology.

If your modem meets the latest standards, chances are that it can take advantage of recent developments in the telephone network and in communications software. These developments help make possible faster speeds and more reliable error correction.

The International Consultative Committee on Telephone and Telegraph (CCITT) sets the standards that ensure international telephone systems connectivity. The CCITT identifies standards on modem data transmission with the letter V followed by a period and a number. Sometimes the letters *bis* follow the number. *Bis* is a French term meaning second version; it denotes a revision of a protocol, not necessarily an extension of the previous version.

The field of modem communications is filled with other terms with similarly explicit meanings. Following is a guide through the alphanumeric jungle of common modem terminology:

MODULATION PROTOCOLS

Bell 103/113 Asynchronous full-duplex modem transmission at up to 300 bits per second.

Bell 212 Asynchronous and synchronous full-duplex modem transmission at 1,200 bps.

HST U.S. Robotics' High Speed Technology: a proprietary modulation allowing connection speeds of up to 14,400 bps. Data flows asymmetrically, at the high speed in one direction and at 450 bps in the other. The modems dynamically negotiate, assigning the high-speed channel to the modem with the most data to transmit.

PEP Packetized Ensemble Protocol: a Telebit proprietary modulation protocol that analyzes the quality of the phone connection at connect time and dynamically compensates for line impairments at 511 separate frequency points.

V.21 Full-duplex modem transmission at up to 300 bps, also used for Group 3 fax negotiation.

V.22 Half-duplex modem transmission at 600 bps and 1,200 bps, with a reverse channel (used mostly for responses during file transfers) at up to 75 bps.

V.22bis Full-duplex modem transmission at 1,200 and 2,400 bps, with fallback to V.22.

V.32 Full-duplex modem transmission at 4,800 and 9,600 bps.

V.32bis The V.32 protocol extended to speeds of 7,200, 12,000, and 14,400 bps, and with an improved renegotiation protocol.

ERROR CONTROL PROTOCOLS

MNP 2, 3, or 4 Microcom Network Protocol: a proprietary, licensed error-control protocol. The numbers indicate specific versions or classes.

V.42 A standard error-control protocol, backward-compatible with MNP 2, 3, and 4.

COMPRESSION PROTOCOLS

MNP 5 Microcom's proprietary, licensed data-compression protocol.

V.42bis An international standard for data compression.

OTHER TERMINOLOGY

Baud An obsolete term defining the number of signal-level changes per second. The CCITT now prefers to use *symbols per second*. For example, a V.22bis connection transfers only 600 symbols per second, but in this protocol each symbol can represent up to four values; thus, you have an effective transmission rate of 2,400 bps. V.32 is a 2,400-symbol-per-second (9,600-bps) modulation protocol.

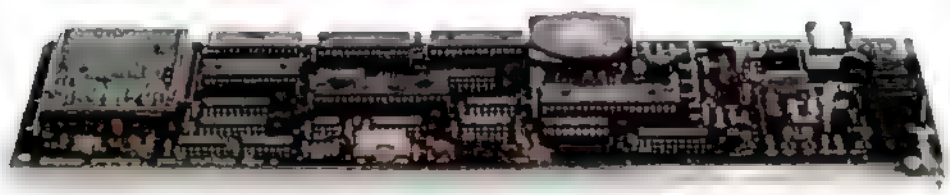
Duplex The direction of data flow between modems. *Half duplex* means that data can flow in only one direction at a time. Data flows both directions simultaneously for *full duplex*.

Throughput The effective rate of data flow for a file transfer, measured in bits per second. Throughput depends on the connect rate and the error-control and data-compression protocols, if any. For example, V.32 indicates an actual 9,600-bps transmission rate. But when you subtract the extra bits used for error control, the effective rate becomes slightly slower. If V.42bis compression can cut a file size in half, the throughput for that file transfer can approach 19,200 bps.

Trellis coding A signal coding scheme. V.32 defines two such coding schemes for 9,600-bps communications: *nonredundant coding* and *trellis coding*. Trellis coding is more noise-resistant except in the presence of an unusual line problem called *impulse noise*.

UART Universal Asynchronous Receiver/Transmitter, the chip that controls the input/output of the serial port. ■

Fax/Modem.
Send/Receive.
View/Print.
Bells/Whistles.
Good/Cheap.
Why/Wait.



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CIRCLE 113 ON READER SERVICE CARD

you can't wait, get an upgrade promise from your vendor.

REVIEW CRITERIA

For this review, we considered only those modems using V.32 signaling with V.42 error checking and V.42bis data compression, the fastest available within CCITT published standards. Not many modems met those criteria; the V.42bis standard is relatively new and costly, and many vendors have delayed the introduction of V.42bis modems because of patent and licensing problems.

One of the products tested, the Hayes V-Series Ultra Smartmodem 9600, offers impressive performance for a small box. When people in the PC market think of modems, they still think of Hayes as the standard of comparison. Modems from U.S. Robotics constitute a different kind of standard. The company recently upgraded its Courier HST Dual Standard to include V.42 and V.42bis. Because of U.S. Robotics' generous price breaks, most electronic bulletin board systems (BBSs) in the U.S. use HST modems. HST's compatibility with BBSs might be an important factor in your purchasing decision.

The other modems we tested were the ATI 9600etc/e, the Microcom QX/4232hs, Multi-Tech Systems' MultiModemV32 MT932EAB, the Telebit T2500, and Universal Data Systems' FasTalk V.32/V42b. The Ven-Tel EC9600-Plus/II arrived too late for review, and Practical Peripherals' new model PM9600SA and Intel's 9600EX did not begin shipping until after our deadline. Other modem vendors plan to sell models in this arena but remain in the legal and engineering stages of development.

THE PACK

A comparison of the modems revealed many similarities. All of the modems we examined are external. While the vendors package each modem with an RJ-11C line cord and telephone plug, in all cases you must furnish your own RS-232C cable. Normally you would use a DB-25P male-to-male cable for most computers.

Each modem can store at least one default configuration to initialize the modem at power-up. These default settings are programmable through your communications software.

The Hayes, Microcom, Multi-Tech, and U.S. Robotics factory-default configurations let our communications program immediately call and answer other V.32/V.42/V.42bis installations. The ATI, Telebit, and Universal Data Systems modems required reading the manual and programming the units to achieve V.32/V.42/V.42bis data transfers. This isn't hard, but it does require some knowledge of modems and their command sets. If any questions arise, all of these vendors offer technical support.

The vendors seem to have solved the problem of complying with the standards, but maintaining compatibility between modems of different vendors is a separate problem. All seven modems comply with V.32/V.42/V.42bis standards. This means that each modem connected and negotiated properly using these standards when connected to like modems. But in many instances, modems from one vendor would not connect to another vendor's modems with all three protocols in force. Nevertheless, the attitude of every company sounds an upbeat note; they all vow to work for intercorporate compatibility, but they aren't there yet.

The attitude of every company sounds an upbeat note. They all vow to work for intercorporate compatibility, but they aren't there yet.

The reasons for incompatibility are not always apparent, but they primarily involve differences in timing or performance thresholds during the handshaking cycle. Each vendor uses its own method and sequence for conducting the protocol handshake, and three offer additional proprietary protocols. Since the handshake method and order of the protocols may influence the final protocol agreement, we strongly recommend that you purchase all your high-speed modems from the same vendor, or at least test the modems for compatibility before you close the deal.

ANOTHER WEAK LINK?

Even with the fastest modem in town, you might not be ready to burn up the phone lines yet. We found another weak link in the communications chain.

Initially we set up our performance tests with two relatively fast Dell System 220s. These AT clones function as our workhorses in most of our workstation LAN testing. But the modem results disappointed us right from the start. The receiving computer just couldn't keep up with the data flow from the sending side. A little investigation revealed that the Dell System 220 contained the old 8250 UART chip usually found in XT machines. Normally AT clones include the faster 16450 UART.

UART (Universal Asynchronous Receiver/Transmitter) chips control the serial port. During modem communications, the PC's UART and the CPU transfer a great deal of information. Unfortunately, if the communications program asks the CPU to manage large changes on the screen or to move data to and from the hard disk, the UART on the receiving side can drop bits, particularly if it runs under a multitasking environment like *DESQview*, *Microsoft Windows*, or OS/2.

The new 16550 UART solves the problem by creating a FIFO (first in, first out) buffer stack. This buffer allows the UART to save any incoming data while waiting on the CPU. Once we changed to faster machines (a pair of ALR PowerCache 4s) with the 16550 UART, our reception problems disappeared. Although the 16550 acts as a direct replacement for the 8250 and 16450, it needs communications software that initializes it to use its FIFO stack. Luckily, most modem communications programs do.

If your old 8250 or 16450 UART still occupies a socket, you can purchase a new 16550 and replace the chip for less than $15. Anyone interested in high-speed modem communications will find this a good investment.

FLYING FAST

Once you've flown at 38,000 bps, it's difficult to grind along at slower speeds. The speed and functionality of these modems is addictive. If you or your business currently uses 2,400-bps modems on phone lines for an hour each day, a V.32/V.42/V.42bis modem can pay for itself through reduced phone costs in less than six months. The arithmetic is easy. Can you afford being without a high-speed modem?

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CIRCLE 364 ON READER SERVICE CARD

ATI TECHNOLOGIES INC.

ATI 9600etc/e

All Reviews by Mike Byrd

The ATI 9600etc/e modem provides quality and performance in a small package for a low price. Its principal assets are simplicity and ease of use. For just $699 you get advanced CCITT communications standards and the most throughput for the buck. The product works reliably, is easy to set up, and offers excellent value.

The 9600etc/e supports the Hayes Standard AT Command Set but extends it to allow tailored configurations for specific applications. The unit also communicates in synchronous mode for use in PC-to-minicomputer or PC-to-mainframe environments.

This modem combines the latest CCITT protocols with older industry standards. It features the V.32 9,600-bps transfer protocol with V.42 error control, plus V.42bis and MNP level 5 data compression. The modem detects V.42 at the remote modem, with dynamic fallback to MNP levels 4, 3, or 2, and it uses no error control if the remote modem does not work with any of these protocols.

Specifically, if the remote modem is not V.32/V.42/V.42bis compliant, the 9600etc/e automatically establishes a connection at the highest mutual operating level. If it cannot establish LAPM error correction, it tries to work at MNP levels 2 to 4. Likewise, if it cannot establish a V.42bis data-compression handshake, it attempts an MNP 5 handshake. Its downward compatibility also includes connectivity with V.22bis, V.22, Bell 212, and Bell 103 modems, and MNP error-correction modems. All of these automated protocol negotiations are invisible to the user.

BRIGHT LIGHTS, SMALL MODEM

The compact black package measures just 6 by 1.5 by 10 inches. LEDs and control switches occupy its front panel. The back panel includes the power switch, power plug, RS-232C connector, and wall/telephone plugs, all of them labeled and easy to read. A slide switch on the right side controls the volume of the 2-inch internal speaker.

The LEDs display 12 status indications: power on/off, modem ready, terminal ready, receive data, send data, carrier detect, error control detect, data mode on/off, auto-answer on/off, transmission speed, synchronous/asynchronous operation, and test on/off. The error control LED shows you when it is connected to another error control modem, but not what type. Red and green lights display modem speed, with combinations representing 9,600, 4,800, 2,400, 1,200, and 300 bps.

The modem's five control switches offer settings for data, auto-answer, speed select, sync select, and test. You can use the data switch to instruct the modem to redial the last number, toggle between voice and data, or quickly disconnect a call. The speed select switch lets you manually adjust the modem speed. The sync switch toggles between synchronous and asynchronous operation.

The brief and concise documentation does not give you a quick reference card, but it needs none since it comes ready for V.32, V.42, and V.42bis operations. The manual specifically explains how the modem negotiates the modulation, error con-

ATI 9600etc/e
ATI Technologies Inc., 3761 Victoria Park Ave., Scarborough, Ontario, Canada M1W 3S2; (416) 756-0718.
List Price: $699.
In Short: The ATI 9600etc/e provides a low-cost alternative among high-speed modems. It offers simplicity and reliability for high-speed file transfers under the most difficult telephone line conditions.

CIRCLE 505 ON READER SERVICE CARD

DATA COMPRESSION: IS IT ALL IT CLAIMS?

by Mike Byrd

If your business transfers files over telephone lines and doesn't use data compression, you are wasting time and money.

Several popular file-compression utilities are available, including *Lharc*, a freeware program, and *PKZIP*, a shareware program. Both offer high file-compression rates. If you compress your files using one of these utilities prior to transmission, you won't need to use V.42bis or MNP 5 to compress them from the modem. In fact, as our tests show, MNP 5 can slow down your throughput by expanding a file during transmission. It won't corrupt the file, however, since the receiving modem eventually strips the bits added to the compressed file.

Of the two popular off-line compression programs, *Lharc* normally offers slightly better compression. *PKZIP* compresses and expands files much faster. Software companies are well aware of the power of these utilities. For example, *CorelDRAW*, Version 1.21B, comes on seven 360K floppy disks. The installation process uses *Lharc* to expand the program's files. Without *Lharc* or another file-compression routine, *CorelDRAW* would easily consume 14 or more disks. You can find *Lharc* and *PKZIP* both in PC MagNet's Utilities Database and in Library 2 of its Utilforum/Tips Forum under the filenames LH113C.EXE and PKZ110.EXE.

THROUGHPUT TESTING

The chart in Figure 1 shows the impact of two types of on-the-fly data compression (V.42bis and MNP 5), along with one software compression scheme (*PKZIP*, Version 1.10), on the throughput of seven types of data files. We used two MultiModemV32 MT932EAB units for these tests. An XT clone from Syntax Computer, attached to one of these modems, transferred the files from its RAM disk. An AST Premium/286 Model 140 with an AST FastBoard 386 was attached to the other modem and received the files.

The **repeated character** file, 43,008 bytes large, included a single repeated ASCII character. The **mixed data** file comprised different types of data, including text, assembly language code, *dBASE* records, and repeated characters; it totaled 44,032 bytes. The **hex**

trol, and data compression protocols, and it includes a noteworthy chapter on troubleshooting. The documentation also offers top-notch diagrams and a thorough explanation of the command set.

RUGGED OPERATION

The performance of the 9600etc/e on typical voice-grade lines is average. But when transferring noncompressible files under impaired line conditions, it shines. It was the only modem that succeeded on the first attempt for each impaired-line file transfer test; it won three noncompressible file tests on impaired lines and took second place on the other three.

We tested ATI modem compatibility with the Multi-Tech and Hayes modems. The Multi-Tech successfully connected with the ATI 9600etc/e in the ATI's host mode but failed to connect when the ATI initiated the call. The ATI did not connect with the Hayes modem in send or receive modes.

ATI supplies a two-year limited warranty, plus free technical support through a toll number and an ATI-supported BBS.

An excellent value, the ATI 9600etc/e definitely offers a good solution to renegotiation problems until V.32bis modems are available. Its incompatibility with the Hayes Ultra 96 is troubling, but we'll bet that it will be solved by the time this issue goes to press.

HAYES MICROCOMPUTER PRODUCTS INC.

Hayes V-Series Ultra Smartmodem 9600 (Ultra 96)

If you want modem standardization and speed, the Hayes V-Series Ultra Smartmodem 9600 (or Ultra 96) marches in the

numbers file was a CCITT file containing a random selection of hexadecimal numbers; it measured 64,512 bytes. The **database data** file, a 77,824-byte CCITT file, was also used in our modem performance tests. The **spreadsheet** file, generated by *Quattro Pro*, totaled 43,250 bytes. The **.TIF graphics** file originated from an image we scanned in using the Logitech hand scanner ScanMan Plus; we cleaned it up with *PaintShow*, Version 2.1, and the resultant file measured 54,272 bytes. The **ZIP compressed** file—compressed by *PKZIP* prior to transmission—measured 52,224 bytes.

COMPRESSION TEST CONCLUSIONS

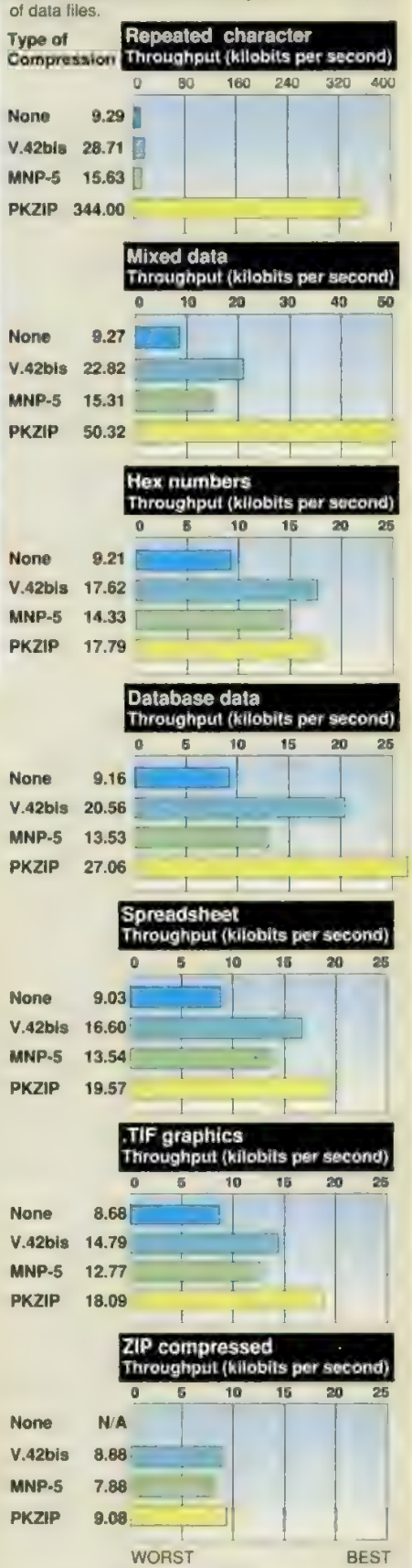
The files with many repeated characters and blank spaces enjoyed compression rates under *PKZIP* far beyond the compression performed by on-the-fly algorithms. The transmission of the file containing the repeated ASCII character went so fast after off-line compression that the throughput number could only be approximated. V.42bis gave the best improvement we found using on-the-fly protocols; on the repeated-character test, it produced more than three times the throughput we measured using an uncompressed file.

Most computer bulletin board systems store their files in compressed form. As our test results show, people using MNP 5–compatible modems should turn off MNP 5 before downloading compressed files (precompression only confuses this protocol, which then expands the file instead of compressing it). V.42bis does not have that disadvantage. It offers real-time data-flow monitoring, turning data compression off and on as needed.

Overall, on-the-fly compression with V.42bis rates as the most desirable and economical mode of operation for most applications. But if you really want to squeeze the most out of your communications lines, compress the files with an external file-compression utility before transmission, and don't use MNP 5 for already compressed files.

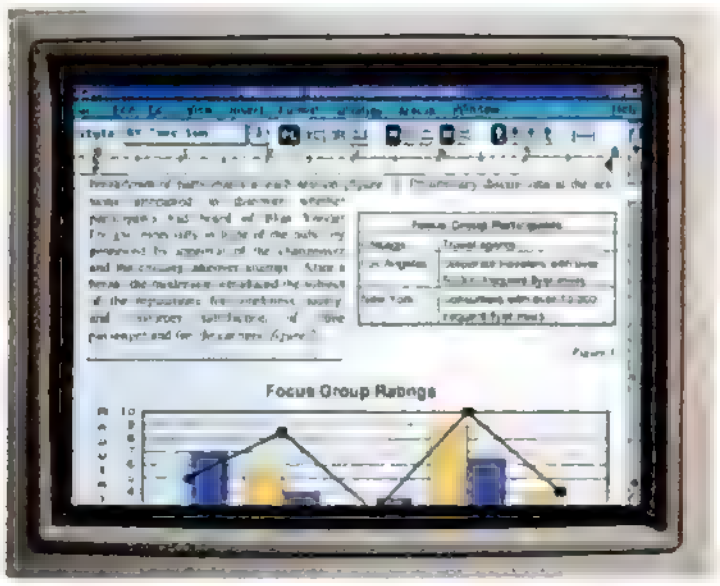
Compression, through either hardware or software, is the best way to save time and money during data transfers. If you are not taking advantage of file compression, someone else is taking advantage of you.

Figure 1: How two types of on-the-fly data compression and **PKZIP** affect the throughput of seven types of data files.



N/A—Not applicable: ZIP compressed files are not transmitted without data compression.

Word for Windows redef



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HIGH-SPEED MODEMS: SUMMARY OF FEATURES

Chip set indicates the company whose support logic provides the heart of the modem—the ability to convert digital signals to analog form and back again. In some cases the chip set is proprietary or custom-made, or it may work in tandem with another chip, like the Motorola 68000 included with the ATI 9600etc/e.

Uses DIP switches DIP switches generally control the configuration of the modem at power-up time. Normally they are set at installation and never touched again. Many users find it easiest to configure modems with DIP switches; others prefer software commands.

Volume of on-board speaker controlled by hardware or software Each of these modems has an on-board speaker, which helps you monitor the call connection, negotiation, and data flow by listening to the sounds the modem makes. You can control the volume either using a manual switch or by setting modem initialization strings through software.

Number of phone numbers stored on-board Each modem can be preconfigured with telephone numbers, which may be used for automatic dialing or remote callback. The MultiModemV32 MT932EAB stores 10 phone numbers on-board for outgoing calls and 30 phone numbers for its callback security feature.

Communications program included Some modem vendors include a communications program with their hardware—often a shareware program you can try right away and pay for later. The FasTalk V.32/V42b includes a certificate for SoftKlone Distributing Corp.'s *Mirror*.

Automatic feature negotiation occurs at connect time. The modems themselves agree on the type of signaling, data rate, error correction, and data communication. Communications software performs the subsequent data transfer.

Configurations stored in memory indicates the number of initialization configurations you can preset in the modem. The ATI 9600etc/e allows you to store two configurations in memory, and it comes from the factory preset with three more on chips.

Warranty period A two-year warranty is standard in the modem industry. You can opt to extend the warranty from Hayes or Telebit for two additional years. U.S. Robotics offers warranty extensions for $25 per year.

PBX control indicates whether the modem can function in a PBX environment. You may have the option of inserting pauses for access to outside lines, or optional dial characters.

Flow control refers to the techniques that the computer and modem use to stop or restart the flow of data from each other. Flow control is necessary because the transmitter or receiver may not always be able to keep up with the rate of transmission; it should be able to tell the other party to stop while it catches up. Flow control signaling includes XON/XOFF, RTS/CTS, and ENQ/ACK.

Modulation protocols can be equated to modem connect speeds. Each protocol indicates a standard electronic signaling format for transmitting data at a specific rate. Trellis-coded modulation works as a fairly noise-resistant V.32 coding scheme for 9,600 bits per second, except under unusual line conditions. The Hayes Ultra 96's Ping-Pong is a 9,600-bps proprietary protocol designed for compatibility with V-Series Smartmodem 9600 modems. The Microcom QX/4232hs supports Bell 103, but currently only Microcom's international model supports Bell 103, V.21.

Synchronous protocols connect PCs to mainframes or minicomputers. They require an external device to provide timing information such as start/stop on data transfers.

Self-tests are used at power-up time and when troubleshooting. They can point to potential problems with the modem or the communications line.

Remote access, control, or diagnostics allow reconfiguration or troubleshooting of a modem from a remote modem.

Telephone-line analysis means the modem has the capability to monitor line noise dynamically and adjust the transmission parameters to achieve optimal throughput.

Auto-dial capability allows the modem to dial a prestored number automatically at power-up or call back a prestored number when triggered by an inbound call.

AT commands (attention commands) initialize and configure a modem for specific applications. Hayes has set the de facto standard for modem commands, and most vendors use the Hayes Standard AT Command Set as a basis for their modem command sets.

Hayes model that most closely resembles the unit's AT command set Because the Hayes Command Set is not yet an official standard, this entry identifies the given modem's command set in terms of the Hayes model it most closely resembles.

Error correction and data compression lists specific hardware protocols available in the modem.

CONTINUES

forefront. Its $1,199 price tag makes it competitive with most other products, while its compatibility and features bring it even better value. This Hayes modem offers full compliance with the CCITT protocol along with the most frequently used modem-industry technologies, allowing it to communicate with PCs, local area networks, mainframes, minicomputers, and synchronous terminals. While the modem lacks status indicators for data compression and error correction, Hayes provides useful extras like country-specific versions of the product.

The unit automatically negotiates with other modems to analyze such features as modulation, error control, and data compression, and to establish the most efficient communications session. This process works transparently, automatically allowing a wide range of capabilities and communications options.

A comprehensive, well-documented chart lists all the commands and register settings, allowing you to initialize or change the internal modem settings yourself. Naturally the Ultra 96 supports the Hayes Standard AT Command Set—but also extends it to implement the new CCITT standards.

ABIDING BY ALL STANDARDS

The Ultra 96 does everything a modem can do: It connects at all current CCITT data rates and standards, including V.32 at 9,600 bps, with V.42 error control and V.42bis data compression. It also supports MNP levels 1 to 4 error control and MNP 5 data compression for compatibility with older modems. Downward compatibility also includes V.22bis, V.23, V.22, V.21, Bell 212, and Bell 103 standards.

HIGH-SPEED MODEMS: SUMMARY OF FEATURES

Products listed in ascending price order

	ATI Technologies Inc. **ATI 9600etc/e**	Microcom Inc. **Microcom QX/4232hs**	Universal Data Systems Inc. **FasTalk V.32/V42b**	Multi-Tech Systems Inc. **MultiModemV32 MT932EAB**	Hayes Microcomputer Products Inc. **Hayes Ultra 96**	U.S. Robotics Inc. **Courier HST Dual Standard**	Telebit Corp. **Telebit T2500**
List price	$699	$1,099	$1,145	$1,149	$1,199	$1,295	$1,345
GENERAL FEATURES							
Chip set	Rockwell, Motorola	Rockwell	Custom-made	Rockwell	Phylon (custom-made)	Rockwell, proprietary	Texas Instruments
Uses DIP switches	❑	■	❑	■	■	■	❑
Volume of on-board speaker controlled by hardware or software	Hardware	Hardware	Software	Hardware	Software	Hardware	Software
Number of phone numbers stored on-board	3	9	4	10	4	4	10
Communications program included	❑	❑	❑	❑	❑	❑	❑
Automatic feature negotiation	■	■	■	■	■	■	■
Configurations stored in memory	2	1	1	1	4	1	2
Warranty period	2 years	1 year	1 year	2 years	2 years	2 years	1 year
PBX control	■	■	■	■	■	■	■
FLOW CONTROL							
XON/XOFF	■	■	■	■	■	■	■
RTS/CTS	■	■	■	■	■	■	■
ENQ/ACK	❑	■	❑	■	❑	■	■
Flow control can be turned off	■	■	■	❑	■	■	■
MODULATION PROTOCOLS							
Bell 103, V.21 (300 bps)	■	❑	■	■	■	■	■
Bell 212A, V.22 (1,200 bps)	■	■	■	■	■	■	■
V.22bis (2,400 bps)	■	■	■	■	■	■	■
V.32 with Trellis-coded modulation	■	■	■	■	■	■	■
Other asynchronous modulation protocols	None	None	None	V.23	Ping-Pong, V.23	HST (proprietary)	PEP (proprietary)
Synchronous protocols supported	Sync	V.22, Bell 212A,V.22bis, V.32	Sync	V.25bis	AutoSync	V.32	V.32, PEP SNA/SDLC
SELF-TESTS							
Local analog loopback	■	■	■	■	■	■	■
Local digital loopback	■	■	■	■	■	■	■
Remote analog loopback	❑	■	❑	■	■	■	❑
Remote digital loopback	■	■	■	■	■	■	■
Test-pattern generation and checking	■	❑	■	❑	■	■	■
Power-on self-test	■	■	■	■	■	■	■
INSTALLATION OPTIONS							
Remote access, control, or diagnostics	❑	■	■	■	❑	❑	■
Telephone-line analysis	❑	❑	■	■	❑	■	■
Auto-dial capability	■	■	■	■	■	■	■
AT COMMANDS							
Uses AT commands	■	■	■	■	■	■	■
Accepts mixed uppercase and lowercase input	■	■	■	■	■	■	■
Hayes model that most closely resembles the unit's AT command set	Ultra 96	2400/9600	Smartmodem 2400	Smartmodem 2400 (early)	Smartmodem V9600	Smartmodem 2400	V9600 Series
ERROR CORRECTION AND DATA COMPRESSION							
CCITT V.42 error-control compliance	■	■	■	■	■	■	■
CCITT V.42bis data-compression compliance	■	■	■	■	■	■	■
MNP levels included	2–5	2–5, 10	2–5	2–5	1–5	1–5	1–5
Other error-correction schemes	None	LAPM	Trellis	None	LAPB	None	CRC (PEP)
Other data-compression options	None	None	None	None	Hayes Adaptive Data Compression (proprietary)	None	Telebit Lempel-Ziv (PEP)

—Editor's Choice ■—Yes ❑—No

ENDS

To get a V.32 9600 modem with V.42bis data compression, you can pay their standard price.

The price of our new 9600EX makes the price of other 9600bps modems look, well, rather inflated. Especially when you consider the quality and features the 9600EX offers.

Features like V.42bis, which compresses data up to 400% and speeds throughput up to 38.4Kbps (it's also downward compatible with MNP5). And V.42 LAP-M and MNP Level 1-4 error control that detects when data is being garbled and automatically retransmits–so you get error-free communication. Or full-compliance with V.32, the industry standard 9600 modem protocol, as well as downward-compatibility with 4800, 2400, 1200 and 300bps modems. The 9600EX also gives you the option to operate on standard phone lines or two-wire leased lines and offers both synchronous and asynchronous transmission.

Fact is, at $799, the 9600EX rivals the price of high-end 2400 modems. Yet, it offers 16 times the performance. Or in other words, more modem for the money.

And that added performance saves you money, too. With the increase in throughput speed, the 9600EX spends less time on the phone so you spend less money on your phone bill. You'll also spend less time waiting for it to finish transmitting–and if time is money–you'll save a bundle.

Plus, like our entire family of 2400 modems, the 9600EX comes with a full, five-year warranty. The new 9600EX modem: another example of Intel's commitment to affordable quality. For more information or a dealer near you, call: 800-538-3373. To have information faxed directly to you, call: 800-525-3019 and request Doc.#9987. And don't be swayed by those over-priced modems, because with everything the 9600EX offers for the money, you might say it just burst their bubbles.

CIRCLE 192 ON READER SERVICE CARD

intel®

V.42bis, MNP 5, and the Hayes Adaptive Data Compression protocol all furnish data compression for connectivity. The last-named is a proprietary protocol found in the Hayes V-Series modems, achieving compression ratios of up to 2:1.

FACT FILE

Hayes V-Series Ultra Smartmodem 9600 (Ultra 96)
Hayes Microcomputer Products Inc., P.O. Box 105203, Atlanta, GA 30348; (404) 441-1617.
List Price: $1,199. BBS operator discounts available.
In Short: Speed, standardization, and compatibility with other Hayes modems make the Ultra 96 well worth considering. It includes the best documentation and a cost-effective feature that enables synchronous communications through the serial port, but it lacks some useful status displays. Country-specific versions are available.

CIRCLE 606 ON READER SERVICE CARD

The Ultra 96 also supports Hayes' proprietary LAPB error control scheme, giving it compatibility with other Hayes V-Series modems. LAPB provides link-level error control for access to packet-switched networks using X.32. The Ultra 96 is likewise compatible with the Hayes V-Series Smartmodem 9600 Ping-Pong protocol for 9,600-bit-per-second and 19.2-kilobit-per-second throughput.

You normally use asynchronous modes for PC communications, but the Ultra 96 can support SDLC, HDLC, and BISYNC synchronous transmission for connection to mainframes and minicomputers. Typically you can connect a PC with a synchronous adapter card to a modem for direct connection with a mainframe. The Hayes AutoSync feature allows you to connect a PC's standard *asynchronous* serial port directly to the modem for synchronous communications. This eliminates the necessity and cost of a synchronous adapter card, and this is a plus when you are comparing prices.

HAYES CLASSIC

After some design excursions in the Hayes product line, the Ultra 96 reflects the classic Hayes design found in the familiar Smartmodem 1200 and 2400. The lights reside where they should, and anyone who has spent a few years plugging in modems will feel comfortable with the Ultra 96.

Although it measures only 5.5 by 1.8 by 9.6 inches, the small-footprint Ultra 96 looks rugged and professional. It comes in a burnished aluminum case with a black plastic front and eight LED status indicators: modem read, terminal ready, send data, receive data, off-hook, carrier detect, auto-answer, and high-speed. There is no status display for error correction or data compression.

The power switch, serial connector, power connector, and wall/telephone connectors are well marked on the back of the case. A 2-inch speaker with a software-programmable volume control lets you listen to the progress of the call and monitor the data transfer.

The Ultra 96 has four DIP switches. Although you normally wouldn't need to access them, you can reach them by removing the front cover. You need to change the default settings only when you connect your modem directly to a printer, use the modem as a dedicated synchronous device, or adjust the carrier level.

The installation guide takes you step by step through the process of connecting the modem to your computer and phone system, and it leads you through any changes required for your particular setup. The documentation is the best we've seen. The user's reference explains in simple English how a modem works and how to set up and communicate using the modem.

> The Ultra 96 reflects the classic Hayes design found in the Smartmodem 1200 and 2400.

In the performance tests, the Ultra 96 rated a solid third. It emerged the overall winner for transferring noncompressible files, indicating the robustness of the V.42bis data-compression algorithm as it turned off data compression when it wasn't needed. The Ultra 96 connected to the MultiModemV32 MT932EAB at 9,600 bps in the latter's host mode, but the MultiModemV32 did not successfully negotiate 9,600 bps with the Hayes when the Hayes was in host mode. The Ultra 96 is fully compatible with the Telebit T2500, FasTalk V.32/V42b, and Courier HST Dual Standard. It would not connect with the ATI 9600etc/e in either send or receive mode.

Country-specific versions of the Ultra 96 are available to comply with each regulatory agency's requirements. Specific

PC LABS

PERFORMANCE TESTS: HIGH-SPEED MODEMS

Running a high-speed modem at top efficiency means eliminating bottlenecks. Make sure your PC has an up-to-date UART, set the port speed to 38.4 kilobits per second, ask vendors whether your communications program and modem setup string are a good match for your modem, and buy modems from the same vendor to ensure compatibility.

The **Baseline** test uses a simulated U.S. telephone line with typical long-distance-circuit levels of such measurable signal characteristics as intermodulation distortion, noise, frequency shift, and phase jitter. Specifically, we used input levels of -10 dBm (decibels referenced to 1 milliwatt) and output levels of -23 dBm, intermodulation distortion of 52 dB and 50 dB for second- and third-level harmonics, a frequency shift of 1.25 Hz, and 8 degrees of phase jitter.

Each of the **Impaired Line** tests (1V32 to 6V32) adjusts the level of envelope delay distortion and the attenuation curve, in addition to other conditions such as phase jitter. With envelope delay, some frequencies transmitted simultaneously are received ahead of others. Attenuation of signals means a drop in volume. For example, test 1V32 introduces 15 degrees of phase jitter, a deviation in phase typical of a circuit with poorly aligned equipment. Other tests introduce noise and rapid excursions of both amplitude and phase, typical of the effects of weather on microwave radio systems.

All of the Impaired Line tests meet the Test Channel Impairment Combination standards established by the EIA for V 32 modems, as described in EIA/TIA standard 496 A. We did, however, adjust the loop loss to U.S. standards to simulate the loss in signaling on a typical phone circuit. Anyone who wants to do the same testing should consult the full EIA documentation and use a product like the TAS 122.

We used two ALR PowerCache 4/33 computers, one at each end of the connection, to send and receive files. These machines come equipped with 33-MHz 80486 processors, while 16550 UARTs control their serial ports. We ran the computers at a port speed of 38.4 kilobits per second to allow maximum throughput. Only the Telebit modem would not support a port speed of 38.4 kbps and had to be set to 19.2 kbps.

We ran Hilgraeve's *HyperAccess/5* as the communications software, and we transferred files using the YModem-G protocol. This protocol has no data compression and no error correction; that makes it the appropriate protocol to run when the modems contain both features. But YModem-G will abort the transfer when any glitch occurs between the modem and the computer.

The TAS 122 Telephone Network Simulator, marketed by Telecom Analysis Systems, helped us simulate a complete telephone network, with capabilities for two- and four-wire connections, dual-tone multifrequency dialing, and internal impairment generators driven by a stored suite of profiles. These profiles meet the standards established for testing by the Electronic Industries Association (EIA). A unit like the TAS 122 is essential for any type of meaningful and repeatable modem testing.

We tested each modem over seven telephone line configurations, and for each line configuration we transmitted four different files provided by the CCITT: a noncompressible file containing a completely random sequence of data; a mixed, compressible file of ASCII characters, database data, repeated characters, and assembler code; a database file; and a .PIC graphics file. All files were over 50K in size.

Noncompressible Data File

Throughput (kilobits per second)

	Baseline Test	Impaired Line Tests					
		1V32	2V32	3V32	4V32	5V32	6V32
Hayes Ultra 96	8.89	5.85	5.88	5.81	5.25	5.42	5.48
Courier HST Dual Standard	8.79	1.56	1.65	1.46	1.58	1.58	1.58
ATI 9600etc/e	8.30	5.58	5.59	5.77	5.69	5.56	5.56
MultiModemV32 MT932EAB	8.22	4.74	5.43	5.33	5.29	5.43	4.80
Microcom QX/4232hs	7.86	5.01	5.05	5.05	5.02	5.04	5.05
Telebit T2500	7.55	N/A	N/A	N/A	N/A	N/A	N/A
FasTalk V.32/V42b	6.78	4.36	4.47	4.42	4.40	4.43	4.40

Mixed Data File

Throughput (kilobits per second)

	Baseline Test	Impaired Line Tests					
		1V32	2V32	3V32	4V32	5V32	6V32
Hayes Ultra 96	22.93	16.78	17.20	15.09	14.83	15.29	16.15
Courier HST Dual Standard	22.05	5.75	5.95	N/A	N/A	5.93	6.52
ATI 9600etc/e	19.77	13.71	13.76	13.87	14.64	13.87	14.39
MultiModemV32 MT932EAB	34.06	22.93	22.05	23.72	22.93	19.66	18.59
Microcom QX/4232hs	34.40	21.77	21.64	21.23	21.10	20.98	21.64
Telebit T2500	31.27	N/A	N/A	N/A	N/A	N/A	N/A
FasTalk V.32/V42b	26.46	16.78	18.01	17.64	18.01	17.11	18.11

Database Data File

Throughput (kilobits per second)

	Baseline Test	Impaired Line Tests					
		1V32	2V32	3V32	4V32	5V32	6V32
Hayes Ultra 96	21.33	15.42	14.97	15.15	15.52	13.84	11.91
Courier HST Dual Standard	26.95	4.99	4.60	4.97	5.14	4.89	5.64
ATI 9600etc/e	19.84	10.94	10.85	10.94	10.71	11.03	12.67
MultiModemV32 MT932EAB	25.35	16.73	16.31	16.73	16.62	12.08	13.40
Microcom QX/4232hs	25.60	16.10	16.20	16.41	16.20	16.20	16.41
Telebit T2500	23.49	N/A	N/A	N/A	N/A	N/A	N/A
FasTalk V.32/V42b	19.54	12.99	13.13	12.99	13.06	12.37	12.80

.PIC Graphics File

Throughput (kilobits per second)

	Baseline Test	Impaired Line Tests					
		1V32	2V32	3V32	4V32	5V32	6V32
Hayes Ultra 96	18.10	10.70	11.60	12.56	11.34	10.56	11.88
Courier HST Dual Standard	18.10	3.45	4.01	3.84	4.01	3.85	4.00
ATI 9600etc/e	15.05	10.27	9.68	8.99	9.50	9.74	10.13
MultiModemV32 MT932EAB	19.24	12.99	12.46	12.26	12.56	12.77	11.69
Microcom QX/4232hs	19.00	11.88	11.26	12.46	12.36	12.77	11.97
Telebit T2500	17.47	N/A	N/A	N/A	N/A	N/A	N/A
FasTalk V.32/V42b	15.20	9.68	10.13	10.13	10.27	10.20	9.93

Greater numbers represent better performance.

N/A—Not applicable: the product did not complete this test.

CONTINUES

To earn the Okidata OK™, we had to re-invent the laser printer.

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The performance and features of the OL400 were good enough to earn it a PC Magazine Editors' Choice Award. But it also had to earn something else—the Okidata OK!

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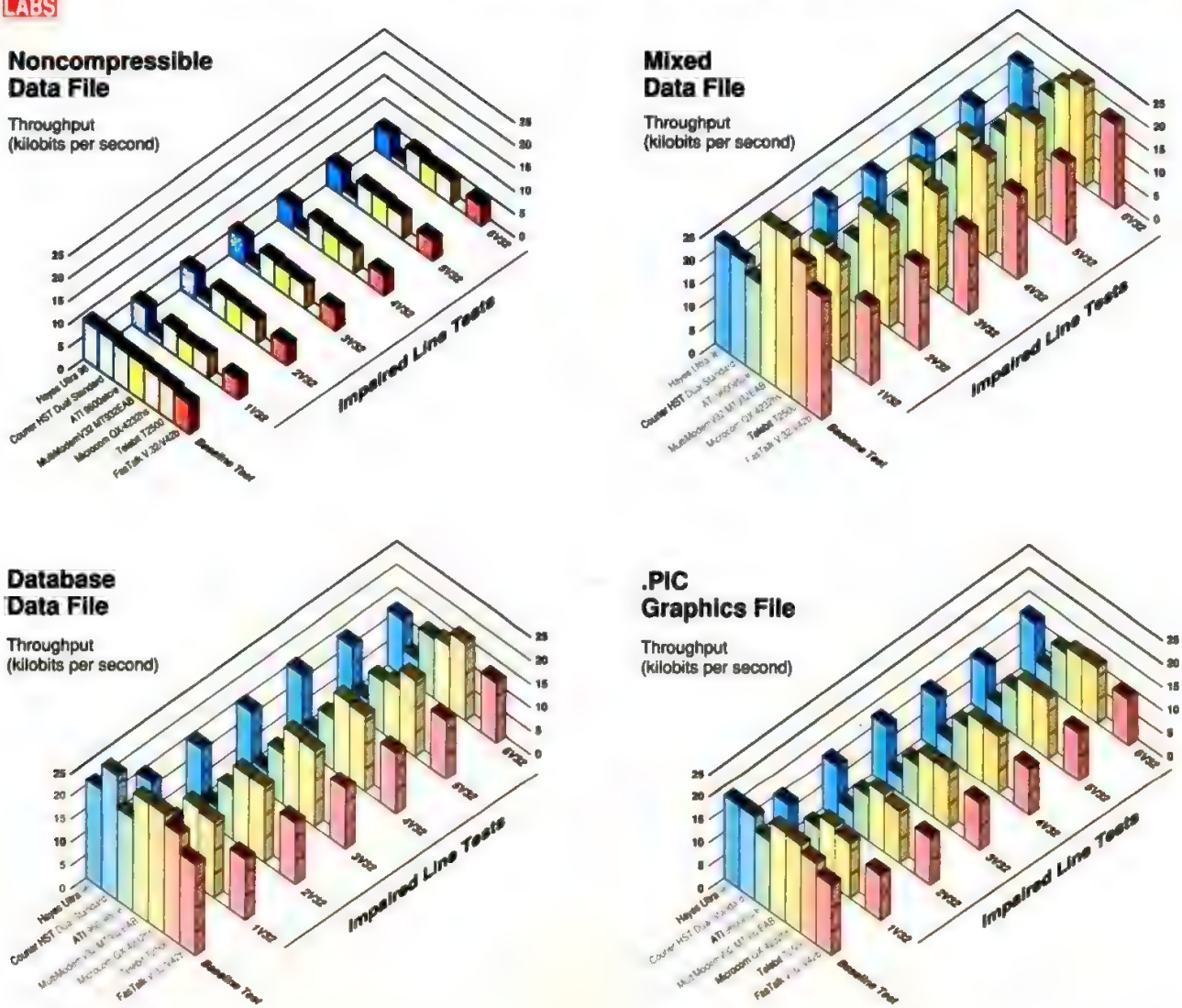
CIRCLE 235 ON READER SERVICE CARD

PERFORMANCE TESTS: COMPOSITE VIEW



(Taller bars represent better performance)

features for a different country's version may vary to meet those requirements.

The Ultra 96 comes with a two-year warranty and free customer support through a toll number or toll-free BBS. The Hayes BBS offers four toll-free lines for messages and information, and four toll lines for file uploads and downloads.

Speed, standardization, and compatibility are the assets of the Ultra 96, which offers connectivity to the most modern Hayes modems as well as older ones. You can't go wrong with Hayes.

MICROCOM INC.

Microcom QX/4232hs

When it comes to industry standards, Microcom not only sets them, it delivers turbocharged performance with its QX/4232hs modem. For $1,099, you get one of the fastest-performing modems that is compatible with the latest MNP and CCITT standards. The QX/4232hs also comes with some handy remote-access features, but it lacks an on/off switch, runs hot, and offers just a one-year warranty.

Microcom derives a competitive edge from its constant push for newer and better standards. The QX/4232hs modem represents the company's current vision of maximum performance and compliance with existing standards. Not only is the QX/4232hs compliant with CCITT V.32, V.42, and V.42bis standards, it embraces all the MNP protocols, including Microcom's new MNP 10 error-correction methodology.

During our testing, we quickly learned the importance of having the proper Universal Asynchronous Receiver/Transmitter (UART) in the test PCs. Machines with slow UARTs often experience overruns on the receiving side when the V.32 and V.42bis protocols deliver fast throughput, so we used fast 16550 UARTs.

We learned another lesson about setting the port speed between the test PCs and the modems. Don't assume that a PC's port speed should be 9.6 kilobits per second simply because that is the signaling speed of the connected modems. Thanks to compression, data comes from the modem with a faster throughput than the modem's signaling rate. Setting the PC's port speed to 38.4 kbps is the best practice.

Furthermore, most communications programs don't have the right initialization strings in place to connect to these new modems. Often the built-in setup strings set the port to 9.6 kbps. If your modem program reports a consistent throughput of 960 characters per second, then the link between your PC and the modem is set to 9.6 kbps, and it is the slowest portion of the entire communications circuit.

We used *HyperAccess/5* as the modem software, working with Hilgraeve's technical support people to develop the proper setup strings for the modems on both sides of the links. When you are using a new modem, a call to the modem or software manufacturer will usually reveal any potential problems, but developing the proper setup string can still be a difficult task.

For our compatibility tests (discussed in the reviews), we didn't try every modem with every other modem in every mode because our initial results with the Hayes Ultra 96 and the MultiModemV32 MT932EAB in originate and answer modes proved the point: Despite the publication of the standard, many modems are not able to establish V.42bis connections with modems from other companies. All of the companies assured us that they were anxious to establish compatibility and were working toward that goal, but they haven't reached it just yet.

THROUGHPUT RESULTS

In the performance tests, Multi-Tech's MultiModemV32 MT932EAB proved the best performer overall, providing the fastest file transfers for about half of the tests. Second place went to the Microcom QX/4232hs, which lost just by a nose. The Hayes Ultra 96 rated a solid third.

On the Baseline tests, run on a standard U.S. telephone line with no special impairment, the modems from Multi-Tech and Microcom show the fastest performance. The modems from Telebit, U.S. Robotics (Courier HST Dual Standard), and Hayes don't lag far behind.

When we introduced the EIA-standard impairments into the lines for the Impaired Line tests, our two leaders stayed clearly in front. When we calculated some averages, Multi-Tech's MultiModemV32 MT932EAB emerged the general winner on four of the six types of V32 Impaired Line tests. The Microcom modem placed first or second on most of the tests in this group. The Courier HST Dual Standard was unable to complete two tests and generally slipped in the rankings. The FasTalk V.32/V42b got going when the going got tough and pulled data through the impaired conditions with little difficulty.

In the noncompressible file tests, Hayes emerged the overall winner, while Microcom slipped in its ranking. The MultiModemV32 MT932EAB was roughly tied with the Microcom unit as the winner for transferring database files, and it won at transmitting graphics files.

Unfortunately, the Telebit modems were not able to complete the data transfer tests under any of the EIA-standard impairment conditions. We saw similar problems using these modems under their native PEP mode.

ENDS

THE MICROCOM EDGE

In a forthcoming review of a Microcom modem using MNP 10 over cellular radio links, we will observe the benefit of this protocol over the poor connections of a cellular phone. MNP 10 automatically and dynamically adjusts data transfer parameters under fluctuating line conditions. It not only slows down transfer rates as line noise increases, it automatically increases the data transfer speed when line noise decreases. The QX/4232hs also supports V.22bis, V.22, and Bell 212A and 103.

This modem boasts compatibility with the Hayes Standard AT Command Set, but extends the command set to let you tailor the modem configuration to include MNP protocols. The factory-default configuration provides for V.32, V.42, and V.42bis operation, but you can implement MNP error-correction and data-compression protocols by using the command set.

The QX/4232hs also supports synchronous operation using the V.32, V.22bis, and V.22 standards. The user reference manual includes a step-by-step tutorial explaining exactly how to configure the modem for synchronous operations using the DIP switches.

The QX/4232hs has remote access features to let your local modem view or change the configuration status of a remote modem. This may be useful in a variety of reconfiguration and troubleshooting situations. You can protect remote access to your modem by means of a password. Auto-log-on features let your local modem automatically access a remote system by executing a predefined log-on sequence. You can use the auto-log-on sequence in either originate or auto-answer mode.

SWITCHES, LIGHTS, AND BUTTONS

The QX/4232hs comes in external and rack-mount models. We tested the external model. Its black molded plastic case measures just 10.7 by 6.5 by 1.8 inches. The front panel contains seven indicator lights and two push-button switches—talk/data and originate/answer. The talk/data switch transfers control between the data line and a telephone connected to the modem. The originate/answer switch controls whether the modem goes off-hook in originate or answer mode when you press the talk/data switch.

Ten DIP switches are located behind the front panel. The rear panel contains a DB-25P serial plug, eight more DIP switches, the power plug, a manual volume control, a reset push button, and the wall/telephone plugs. The reset button functions just like a reset button on your computer; pressing it is equivalent to unplugging the modem and plugging it back in. You can adjust the volume control with a screwdriver, but the modem has no power switch.

The seven LEDs include power, test, off-hook, high-speed, data terminal ready, transmit, and receive. The test light flashes when the modem retransmits, showing that error correction is taking place. The high-speed LED indicates connect speeds from 300 to 9,600 bps through a combination of blinking green and red lights, and it helps compensate for the lack of a data compression display.

The 18 DIP switches control the modem configuration and the instructions it uses at power-up. The circuit board also contains a number of jumpers. Usually you will not need to adjust any of these unless you need a nonstandard configuration.

On the downside, with all those other switches you would hope to see an on/off switch on the QX/4232hs, particularly

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3½" floppy	Option	Option	1 — 1.4 MB
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Ports	2 Serial 1 Parallel	2 Serial 1 Parallel	2 Serial 1 Parallel
Power	200 Watt	200 Watt	250 Watt
Configuration	Desk Top	Desk Top	Tower
Keyboard	101 Style	101 Style	101 Style
Mouse	Option	Option	Standard
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Standard software	DOS (3.3 or 4.01)	DOS (3.3 or 4.01)	DOS (3.3 or 4.01)
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CIRCLE 537 ON READER SERVICE CARD

FACT FILE

Microcom QX/4232hs
Microcom Inc., 500 River Ridge Dr., Norwood, MA 02062; (800) 822-8224, (617) 551-1958.
List Price: $1,099.
In Short: Microcom lives up to its reputation for state-of-the-art high-speed data transfer. The QX 4232hs is a top-line modem for CCITT- and MNP-compatible connectivity. It includes the new MNP 10 protocol and useful remote-access features, but the warranty is for one year.

CIRCLE 607 ON READER SERVICE CARD

since it runs extremely hot to the touch compared with the other modems we tested. Microcom, please let us turn this thing off without pulling the plug out of the wall.

SECOND-BEST, BUT CATCHING UP

The reference manual is succinct and clear, and it comes with a quick-reference card. The guide has setup examples for using the modem over poor phone lines, along with three common host-to-remote installations. It also describes the configuration requirements for each of six popular software programs: *Carbon Copy Plus, Crosstalk Mk.4, Crosstalk XVI, HyperAccess, ProComm Plus,* and *Relay Gold.*

Second place is not winning, but the QX/4232hs just lost by a nose. It placed consistently first or second in most of our file and line impairment tests. The only problems we encountered occurred in the noncompressible file tests, where it slipped in its ranking. When it was second, it lost only by a slight margin. Lower-placing modems ran significantly slower in most categories. The QX/4232hs connected successfully with the MultiModemV32 MT932EAB and the Hayes Ultra 96.

The unit comes with only a one-year warranty, but unlimited, free technical support is available via a toll number.

Microcom is clearly gunning for number one. The QX/4232hs is an excellent modem for any application.

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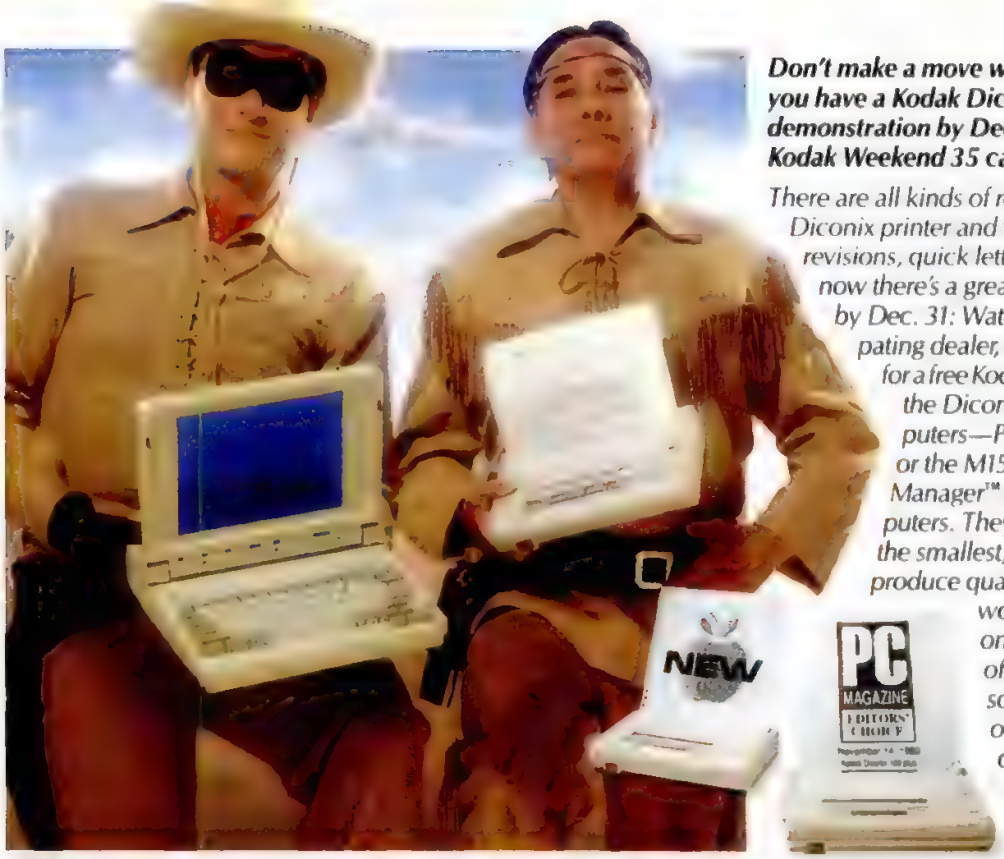

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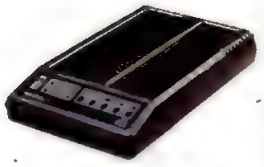

If you're a little old lady from Pasadena, you can probably pass on this baby. But if you're into high speed transmission and superior performance (at a price that's easy to handle), you're going to want to shift into the ATI 9600etc/*e* Modem.

Gear Up To 38,400 BPS

In a clutch or anytime, the 9600etc/*e* can perform at mind-boggling speeds. By combining the industry standard V.32 protocol with V.42*bis* data compression, the 9600etc/*e* can simultaneously transmit and receive data at over 38,400 bps... four times faster than other 9600 bps modems. Imagine the savings on transmission costs.

Easy Handling

Check out the dash. ATI's Easy-Set Front Panel gives you convenient access to frequently used commands. Whether you drive a PC or a mainframe, the 9600etc/*e* provides 100% error-free data transfer. Completely compatible with the Hayes* 'AT' command set, the 9600etc/*e* also supports MNP* protocols and slower modems operating at 2400, 1200 and 300 bps.

The ATI 9600etc/*e*. *VROOOOOM.*

For more information, contact your supplier or

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CIRCLE 337 ON READER SERVICE CARD

MULTI-TECH SYSTEMS INC.

MultiModemV32 MT932EAB

Multi-Tech Systems' MultiModemV32 MT932EAB emerges a winner under the most constraining telephone line impairments. For $1,149, you get the highest overall rates we measured for data transfer using V.32 communications, V.42 error correction, and V.42bis data compression with and without telephone line impairments. Its command instruction set offers considerable configuration flexibility for specific applications. This modem will save you both time and telephone costs.

Although Multi-Tech claims compatibility with the Hayes Standard AT Command Set, it extends that command set to permit user control of the modem's configuration. The extended command set is very powerful but complex. All the commands are self-explanatory, and they offer complete control of the modem's internal configuration, but the multitude of commands can be confusing.

RELIABILITY AT ANY SPEED

The MT932EAB uses the latest available technologies to achieve reliable high-speed and full-duplex operations over dial-up and two-wire lines. V.42 error-correction and V.42bis data-compression options minimize transmission errors while increasing modem throughput to 38,400 bps.

The MT932EAB's strengths include the ability to connect at these protocols and its support for MNP 2 to 4 error correction and MNP 5 data compression. The MT932EAB can also connect with other modems using V.32, V.22bis, V.22, Bell 212A, and Bell 103/113. These features provide compatibility with lower speeds and should allow the MT932EAB to talk to virtually any modem almost any time.

The factory-default settings strive to connect using the most efficient data rate, error correction, and data compression available between the two modems. If

MultiModemV32 MT932EAB
Multi-Tech Systems Inc., 2205 Woodale Dr., Mounds View, MN 55112; (800) 328-9717, (612) 785-3500.
List Price: $1,149.
In Short: The MultiModemV32 MT932EAB offers flexible compatibility with a variety of modems using CCITT and MNP protocols. It can be configured for almost any application; it works under severely impaired lines, and it wins first prize for fast data transfers.

CIRCLE 611 ON READER SERVICE CARD

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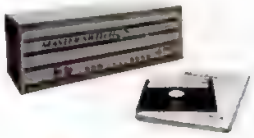

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CIRCLE 290 ON READER SERVICE CARD

both modems are capable, the transfer rate will be 9,600 bps with LAPM error correction and V.42bis data compression. If the modems connect with LAPM, MNP 5 data compression is available for communicating with modems that are not V.42bis compliant.

MONITORING BY SOUND AND LIGHT

The unit comes in an off-white molded plastic case measuring 7.3 by 1.6 by 11 inches. The front panel uses eight LED status indicators, a voice/data toggle switch, and a 9,600-/2,400-/1,200-bps speed selection switch. Twelve DIP switches are accessible through the bottom of the modem chassis. The back contains the power connector, DB-25P serial connector, power switch, volume control, and wall/telephone plugs. All connectors are well marked, but Multi-Tech places the power switch between the DB-25P connector and the line jack, making on/off operations awkward with the cables connected.

You can monitor calls with the 2-inch cone speaker and adjust the volume through the rear of the modem case. The eight LED indicators show the status for send data, receive data, carrier detect, off-hook, terminal ready, and 9,600 bps, 2,400 bps, and 1,200 bps. Three dual-purpose speed lights indicate the type of error correction and data compression by different blink rates—an excellent feature when you want to monitor the modem connection.

The MultiModem was the best performer, providing the fastest file transfers for more than half the tests.

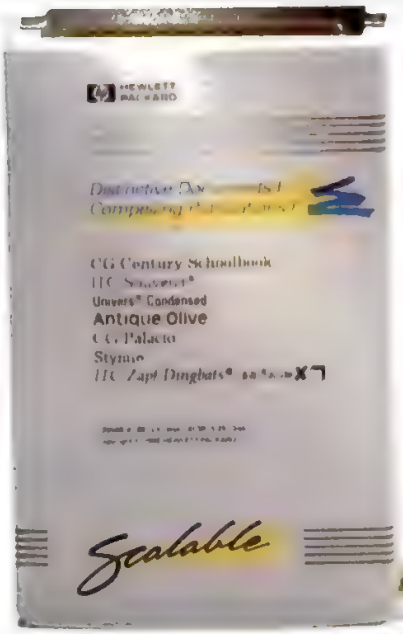
The twelve DIP switch positions control the modem's initialization or set default values for the command mode. The DIP switch functions differ depending on whether you are operating in synchronous or asynchronous mode. Jumpers inside the modem control CTS/RTS, CTS V.25bis, SDLC or DSC mode, and DSR options.

The clear and concise documentation provides insight into modem operations. There is no separate quick-reference card, but every modem includes a summary of switch settings located on the bottom right next to the easily accessible DIP switches. You couldn't ask for a design that is easier to set up.

The package offers an interactive automatic-dialing capability and a command mode option. You can store up to ten commands or telephone numbers in the modem's nonvolatile memory. The modem can recognize dial tones and busy signals for reliable call-progress detection.

WINNING PERFORMANCE

The MT932EAB proved the best performer overall, providing the fastest file transfers for over half of the tests. It emerged as the general winner for four of the impaired line tests. It also tied with the Microcom unit as the winner for transferring database files, and it won the race to transmit graphics files. It came in third for transferring noncompressible files, but only by a small



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margin. Overall, the MT932EAB possesses an excellent implementation of the V.42bis data-compression algorithm.

Compatibility with other V.32 modems remains an issue. The Hayes Ultra 96 and the Courier HST Dual Standard connected successfully with the MT932EAB in the host (answer) mode. But when the MT932EAB functioned as the calling modem, it did not connect with the Ultra 96, and it aborted file transfers with the Dual Standard. Although the MT932EAB connected successfully to the ATI 9600etc/e in the ATI's host mode, it did not connect when the ATI was in the originate mode and the MT932EAB in the host mode. And the FasTalk V.32/V42b did not connect to the MT932EAB in either direction.

The MT932EAB includes an industry-standard two-year warranty, with free technical support through a toll-free number. Multi-Tech also maintains a bulletin board service for its customers, providing new product information, product upgrade data, problem-solving tips, and message support.

If you choose the MultiModemV32 MT932EAB, its ease of setup and high-speed efficiency over both standard and impaired lines will transfer your files faster and help keep your long-distance charges down.

TELEBIT CORP.

Telebit T2500

The Telebit T2500 executes high-speed file-transfer operations using either the CCITT protocol standards—for worldwide compatibility and error-free, data-compressed transmission—or its own proprietary Packetized Ensemble Protocol (PEP). For a high $1,345 you get a V.32/V.42/V.42bis-compliant modem allowing connectivity from 300 to 9,600 bps. The Telebit modem did not perform well under any of our degraded-line tests using either its V.32 or PEP mode. Also on the minus side are its one-year warranty, nonstandard defaults, and lack of LED indicators for speed, data compression, and error correction, but the modem does offer useful built-in security features.

The T2500 supports error correction over standard full-duplex V.32, V.22bis, V.22, and Bell 212 and 103 connections. It fully implements V.42, providing backward compatibility between V.42 and existing MNP modems. And it supports MNP 5.

The unit can also connect using the PEP modulation protocol. PEP overcomes some telephone-line limitations. It analyzes the quality of the connection at 511 separate frequency points and compensates for existing line impairments. This reduces retransmission of blocks and improves data throughput.

PEP dynamically provides real-time line analysis and adaptation to achieve maximum data transmission during the connection. With PEP, the modem can transmit or receive asynchronous data at up to 18,000 bps over standard telephone lines, or up to an effective 19,200 bps when data compression is turned on. PEP is available only when you are connecting to another Telebit modem.

The T2500's callback security feature allows an originating user to dial a predefined number. The answering modem prompts for a password. If the originating

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HEWLETT PACKARD

modem sends a valid password, the answering modem hangs up the phone, waits 10 seconds, then calls back. Because the called modem has the originating modem's number indexed against its password, the called modem can easily look up the number. Password security is also available to control connections between selected modems.

SELECTION BY SWITCH

The off-white molded plastic Telebit unit measures 8.5 by 2.4 by 13 inches. The front displays eight LED status lights, an A/B configuration toggle switch, and a talk/data switch. The LEDs show PEP status, carrier detect, off-hook, receive data, send data, clear to send, data terminal ready, and modem ready. The well-marked back contains the power switch, power plug, DB-25P serial plug, and wall/telephone plugs. An internal speaker, with software-programmable volume, facilitates call-connection and data-transfer monitoring. The modem provides no visual indications of the speed, error correction, or data compression technique in use.

The T2500 also has no DIP switches; instead, it comes with four factory-default configurations. You choose among them with the A/B toggle switch and talk/data switch.

You can select one of two possible operating profiles with the A/B switch. When you turn on or reset the modem, it loads its initial configuration from the profile indicated by the A/B switch position. The talk/data switch contains several functions, depending on the profile loaded at power-up. It lets you switch from data to voice or vice versa. When appropriately configured, it can automatically dial a preset number.

If you want the Telebit T2500 to connect with another T2500 using V.32, you must instruct it to do so. If they can't connect at 9,600 or 4,800 bps, the modems break connection.

The LEDs visually display any of the four modes selected: enhanced command mode (asynchronous), conventional command mode (asynchronous), enhanced command mode (SDLC synchronous), and enhanced command mode (V.32 synchronous). Telebit's user reference gives clear, step-by-step instructions on how to select the mode desired.

You get both a fast-start guide and a user reference as documentation. The user reference includes tear-out quick-reference guides for both conventional and enhanced command sets. While it is thorough, this user reference is intended for computer and terminal users who possess a basic understanding of data communications.

A NOVEL APPROACH

Telebit takes a slightly different approach to connecting. Ordinarily it always tries to select PEP over V.32 and lower-speed protocols. When you want a V.32 connection to a different vendor's modem, this is not a problem. But if you want a T2500 to connect with another T2500 using V.32, you must instruct it to do so. If they cannot connect at 9,600 or 4,800 bps, the modems break connection.

Normally the modem will automatically handshake to check for LAPM or MNP 4 error correction. If LAPM is agreed on, the modems negotiate the use of V.42bis. If V.42bis is not suitable, or if they select MNP 4, the handshake continues to check whether they can agree on MNP 5 data compression. If not, the modem performs no data compression.

The unit gave us a few headaches while we were trying to set up for V.32/V.42/V.42bis testing. Because the default configuration tries to connect with another Telebit modem using PEP first, we needed several phone calls to technical support to get the modem configured for our performance tests.

The T2500 showed average performance on the baseline tests. It was not successful for any of our 24 impaired line tests, despite repeated tries and extensive consultation with the company. It connected with the Multi-Tech modem when the Telebit originated the call, but not when the Multi-Tech originated a call to the Telebit. It did connect successfully with the Hayes Ultra 96 in both originate and answer modes.

The unit comes with only a limited one-year warranty, but optional coverage is available for a second and third year. Unlimited technical support is free through a toll number.

The Telebit T2500 gives you high-speed data compatibility with both Telebit modems and V.32 modems, and it includes all the current advanced CCITT protocols for error control and data compression. But because it did not pass the impaired line tests, we cannot recommend this modem.

Telebit T2500
Telebit Corp., 1315 Chesapeake Terrace, Sunnyvale, CA 94089; (800) 835-3248, (408) 734-4333.
List Price: $1,345.
In Short: The Telebit T2500 is a high-speed modem suited to large-file transfers with Telebit and other fast CCITT-compliant modems over noise-free lines. Its callback security feature is a plus. Drawbacks include the one-year warranty, unusual configuration, lack of some useful status displays, and difficulty with impaired lines.

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UNIVERSAL DATA SYSTEMS INC.

FasTalk V.32/V42b

The FasTalk V.32/V42b represents a step toward Universal Data Systems' goal of becoming the fastest, most reliable source for high-speed modems. For $1,145, the FasTalk supports the major CCITT and industry connectivity protocols, but it doesn't include some of the connectivity options found in its competitors.

The FasTalk connects your PC or computer terminal to telephone or leased-line operations at 300, 1,200, 2,400, 4,800, or 9,600 bps. It can be complicated to set up at first, but advanced CCITT error control

FasTalk V.32/V42b
Universal Data Systems Inc., 5000 Bradford Dr., Huntsville, AL 35805-1993; (800) 631-4869, (205) 430-8000.
List Price: $1,145.
In Short: The FasTalk V.32/V42b meets industry standards for connectivity, allowing you to tailor it for special applications. The initial configuration process can be complicated, but the unit works solidly under impaired line conditions. Its warranty period is only one year.

CIRCLE 609 ON READER SERVICE CARD

and data compression provide maximum compatibility. This helps ensure data integrity and increased data throughput, making the FasTalk a solid performer when telephone line conditions are less than optimal.

The FasTalk offers full compliance with the CCITT V.32 standard for full-duplex transmission at 9,600 bps. It incorporates V.42 and MNP level 2 to 4 error-control functions for dependable data transmission over noisy telephone lines, while modem-negotiated V.42bis or MNP 5 data compression increases overall throughput. The unit automatically adjusts its data rate and modulation protocol to the other connected modem. It will connect with any modem compatible with V.32 at 9,600 bps, Trellis coded or uncoded; 9,600 and 4,800 bps, synchronous or asynchronous; CCITT V.22bis 2,400 and 1,200 bps, synchronous or asynchronous; and Bell 103J 300 bps, asynchronous.

COMPLEX CONFIGURATION

The FasTalk starts with the Hayes Standard AT Command Set but extends it to allow many user options over a wide range of operating environments. You can configure it to answer and negotiate a variety of configurations, depending on your requirements. For example, you can specify the type of V.42 protocol (LAPM or MNP) or the type of data compression (V.42bis or MNP 5) for the handshake to agree on. This level of detail is not available in most other modems.

Surprisingly, the UDS factory defaults call for a configuration of 2,400 bps, with no error control or data compression. The FasTalk comes out of the box thinking that it is a plain-vanilla V.22bis modem. To enable V.32, V.42, and V.42bis or the MNP levels, you must manually reprogram the initialization configuration—not a difficult operation, but strange considering the expense of this high-speed modem. If you buy it, you will probably want to use it in its fastest mode.

The FasTalk is synchronous, capable of several configuration options depending on the application. The default configuration caused some complications in preparing the modem for testing, requiring several phone calls to the technical support group before we could configure the modem properly to V.32/V.42/V.42bis standards.

FasTalk uses one internal jumper that selects the modem configuration at power-up. The user reference explains the settings for this jumper with the help of excellent instructions and schematic drawings. Alternatively, you can choose to stay with the factory or stored configuration. Other jumpers reside on the board, but the book cautions you not to alter them. The documentation is quite thorough; in addition to the reference manual, you get a quick-reference card. Yet once you install the modem, you will rarely require the references again.

Once configured, the FasTalk should connect with any CCITT or industry-standard high-speed modem that uses V.32, V.42, or MNP 2 to 4, and V.42bis or MNP 5. It will also talk to most lower-speed modems.

LED SIGN LANGUAGE

The off-white molded plastic unit measures 6 by 1.5 by 9.5 inches. The rear panel displays the well-labeled on/off switch, power jack, DB-25P serial connector, and wall/telephone jacks. The front panel contains the talk/data switch and eight LED indicators. The talk/data switch allows you to originate or answer both data and voice calls manually. An internal speaker with software-controlled volume lets you monitor call connections and data transfers.

The modem-status LED indicators show error control, modem ready, terminal ready, send data, receive data, off-hook, carrier detect, and high-speed conditions. The error control light turns on when the modem connects in an error control state—V.42 or MNP 2, 3, or 4—but you don't see a visual indication of the type of error control in use.

The high-speed light turns a persistent green during 9,600-bps operation. It flashes green at 4,800 bps and shines a steady red during 2,400-bps operation, with flashing red at 1,200 bps. The LED shuts off during 300-bps operation.

COMPARATIVE PERFORMANCE AND FEATURES

Once properly initialized, the modem gave average performance. It did better than many of its competitors during the impaired line testing, consistently ranking third for the mixed data file transfers and third or fourth for the database file transfers over impaired lines. It would not connect with the Multi-Tech unit at 9,600 bps but did connect successfully with the Hayes Ultra 96 in both send and receive modes.

The modem comes with only a one-year warranty, but UDS staffs a toll-free telephone number to provide unlimited technical support.

The FasTalk starts with the Hayes Standard AT Command Set but extends it to allow many user options over a wide range of operating environments.

The FasTalk V.32/V42b doesn't include certain connectivity features that separate it from the rest of the pack. Other modems, such as the Hayes, Microcom, Telebit, and U.S. Robotics units, contain useful proprietary modes and bells and whistles. The ATI modem distinguishes itself on price, the Multi-Tech on performance. Nevertheless, the FasTalk proves itself a solid performer when telephone line conditions are less than perfect.

Hayes ESP™

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U.S. ROBOTICS INC.

Courier HST Dual Standard

Flexibility, compatibility, and high-speed data flow are the hallmarks of U.S. Robotics' Courier HST Dual Standard modem. For $1,295 (or $1,249 for the internal model), you can communicate with CCITT V.32 modems and all HST modems. Although the unit runs into trouble on severely degraded phone lines during V.32 transmissions, its flexibility gives you access to synchronous and asynchronous modems ranging from 300 bps to 14,400 bps using the major data-transfer standards: CCITT, Bell, and HST.

The PC LAN Labs crew liked the Courier HST Dual Standard modem because it's easy to use and versatile. Also, U.S. Robotics products enjoy an excellent reputation earned over years of service.

The PC LAN Labs crew likes this modem because it is easy to use and versatile. Also, U.S. Robotics products enjoy an excellent reputation earned over years of service. So we were quite surprised to see marginal performance from the Dual Standard on degraded telephone lines. When the going got tough, it slowed down considerably and often aborted transfers.

CONNECTIVITY SMORGASBORD

The Dual Standard offers a smorgasbord of connectivity protocols, along with two specific options for high-speed connectivity, CCITT V.32 and the company's proprietary HST modulation protocol. At pre-

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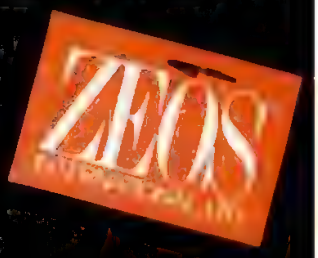

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- ☑ *2. Share access to a modem*
- ☑ *3. Exchange electronic mail and messages with other users*
- ☑ *4. Electronically transfer data files between computers (rather than pass diskettes)*
- ☑ *5. Access a common library of data files, like drawings, document templates, memos, boilerplate, etc.*
- ☐ *6. Access a common database, where multiple users must access the same records simultaneously (e.g. an order entry system)*

If you checked any or all of the first five capabilities listed above, but not number six, your company does ***not*** need a full-blown LAN. This news can save your company a lot of money and make life much simpler for everyone concerned. Skip to the next paragraph immediately. If you selected the sixth capability, a data-sharing LAN is needed, but only for those users who must access the shared database. To achieve the other capabilities, your best—and most economic—solution is...

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sent the fastest connectivity is with HST-compatible remote modems. When connected to a V.32 modem, the Dual Standard allows 9,600-bps transmissions; the HST mode yields transfer rates up to 14,400 bps when the unit is connected to

The Courier HST Dual Standard offers a smorgasbord of connectivity protocols, along with two specific options for high-speed connectivity, CCITT V.32 and the company's proprietary HST modulation protocol.

another HST modem. If it encounters a slower remote modem—or noise too severe for high-speed connectivity—it slows down.

Specifically, if the remote modem is not HST compatible but is V.32 compliant, the modems try to connect at 9,600 or 4,800 bps instead. If the line conditions or the remote modem are neither HST nor V.32 capable, the modems try to connect at 2,400, 1,200, or 300 bps. After the modems agree on the transfer protocol, they negotiate error control and data compression in the same manner.

The Dual Standard supports V.42 and MNP 1 to 4 error control protocols. If the remote modem supports an error control protocol, it enables V.42 in one of its two modes. The modems select data compression using either V.42bis or MNP 5. The Dual Standard supports all major modulation standards, including Bell 103 and 212 and CCITT V.22bis, V.22, and V.21. All of these protocols are available in any combination for the most efficient connectivity.

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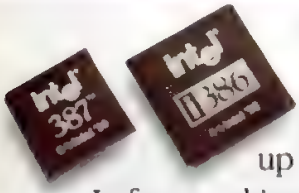

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Courier HST Dual Standard
U.S. Robotics Inc., 8100 North McCormick Blvd., Skokie, IL 60076; voice (800) 342-5877, (708) 982-5001 BBS (708) 982-5092
List Price: External or rack mount, $1,295, internal, $1,249 BBS operator discounts available
In Short: The Courier HST Dual Standard is a versatile high-speed modem geared for automatic connectivity with both asynchronous and synchronous modems, but it's not suited to high-speed V.32 data transfers on telephone lines with severe signal degradation. It includes a handy DIP switch chart at the bottom

CIRCLE 610 ON READER SERVICE CARD

but you can override any of them by commands to the modem for specific applications. By changing the default power-on configuration, you can force a Dual Standard modem to use the V.32 protocol rather than HST when it talks to another Dual Standard, but normally this results in slower transmissions.

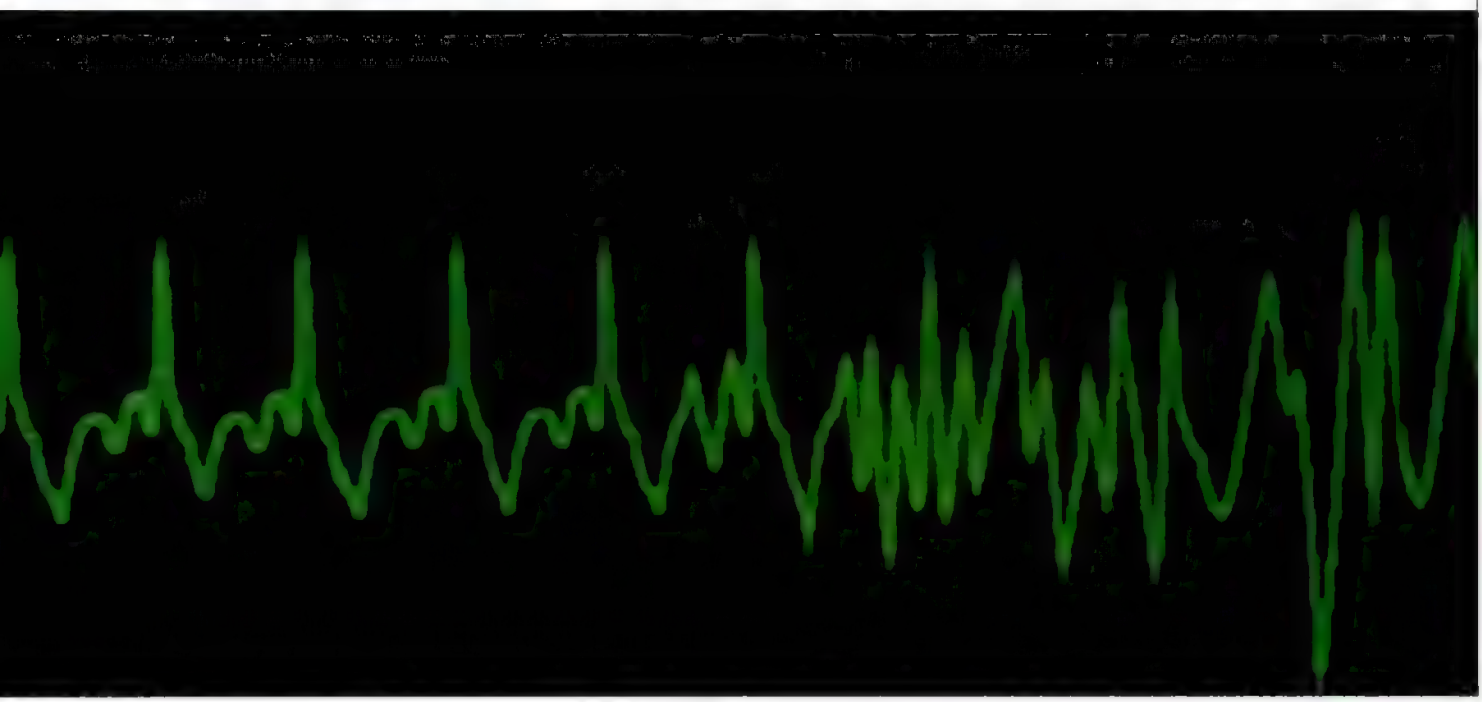
The Courier HST Dual Standard uses the Hayes Standard AT Command Set, along with an extended command set to address all the configuration and protocol options. Your commands can override the DIP switches and initialize or change the modem settings.

The Dual Standard is available in external, internal, and rack-mount models. We tested only the external model. Its black molded plastic case measures 8.3 by 1.6 by 12.7 inches. The front displays 12 LED status indicators. The well-marked power switch, DB-25P serial connector, power plug, 10 DIP switches, and wall/telephone plugs occupy the back of the case. As usual, you can monitor call connections through an internal speaker, using a software-programmable volume control.

SIGNAL LIGHTS BUT NO SPEEDOMETER

The LED status indicators include high-speed, answer, carrier detect, off-hook, receive data, send data, terminal ready, modem ready, request to send, clear to send, error control, and synchronous mode. The high-speed LED comes on for connections above 2,400 bps; there is no differentiation between an HST and a V.32 connection. The error control LED is on when the modem successfully connects with another modem using error control. Again, you

U.S. Robotics includes a good chart on the bottom of the modem explaining the function and the default setting of each DIP switch.



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won't know whether the connection is V.42 or MNP 1 to 4.

U.S. Robotics includes a good chart on the bottom of the modem explaining the function and default setting of each DIP switch, making it easy for you to adapt the modem to your equipment and your own requirements from power-on defaults. The company deserves high praise for this simple and inexpensive step. Furthermore, it provides a pamphlet describing switch settings for the major communications programs. Once they're set, you rarely have to change them.

Documentation for the Courier HST Dual Standard encompasses all the U.S. Robotics high-speed modems—the Courier HST Dual Standard, Courier HST, and Courier V.32. The common user manual reflects the degree of compatibility between these modems. Explanations of the modem instruction set are clear and precise. Even if you know very little about modems, you'll find the descriptions easy to follow.

Since the unit is equally adept with synchronous applications, the manual devotes an entire chapter to steps for converting to synchronous operation. You also get a handy quick-reference card for the modem commands, DIP switch settings, and S-register values.

U.S. Robotics supplies free technical support over a toll-free number, along with a BBS offering product news, upgrades, discounts, and user e-mail conferences.

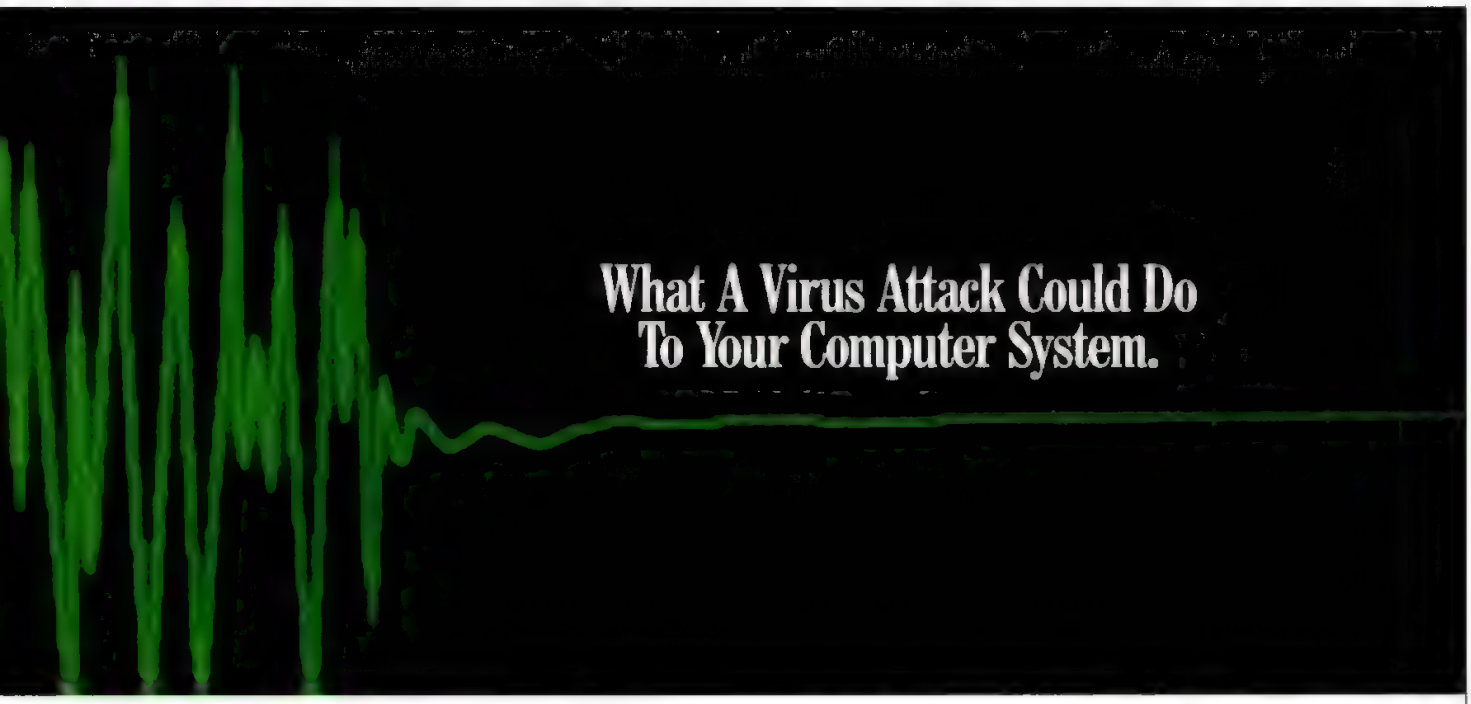
The overall performance was disappointing. The Courier HST Dual Standard did rate first for transferring database files in the baseline tests, but its performance on CCITT impaired telephone line tests was substandard. We conducted all tests in the V.32 mode, so no conclusions about the performance of the HST modulation mode should be drawn from these tests.

The Courier HST Dual Standard did connect with the MultiModemV32 MT932EAB at 9,600 bps and vice versa, but it aborted the file transfers when it was in host mode. It is fully compatible with the Hayes Ultra 96.

U.S. Robotics supplies free technical support over a toll-free number, along with a BBS offering product news, upgrades, discounts, and user e-mail conferences. The unit comes with a two-year parts-and-labor warranty, with warranty extensions available at $25 per year.

The Courier HST Dual Standard performs well except over severely impaired telephone lines. Its strength lies in its versatility, with a variety of protocols for automatic connections to other modems. ■

Mike Byrd, *a fighter pilot for the U.S. Air Force, is a division chief in a branch of the federal government that develops sophisticated electronic systems.*



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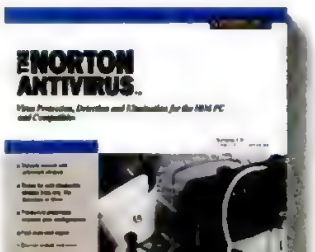

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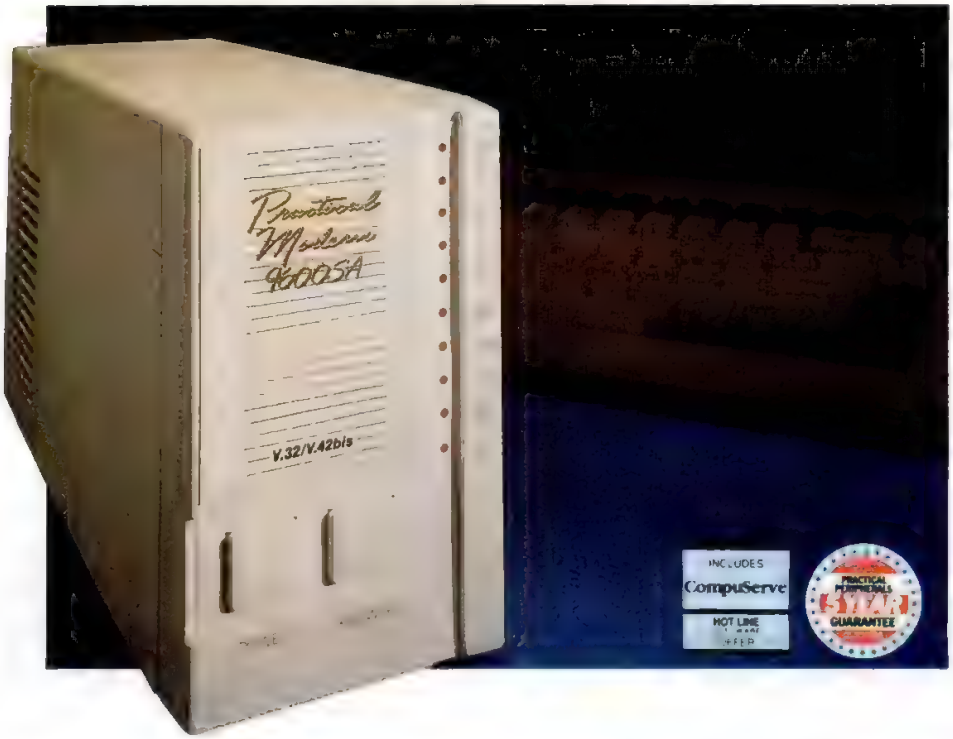

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CIRCLE 219 ON READER SERVICE CARD

Fax Line Managers: THE Electronic Call Director

Sharing a single telephone line among voice callers, a fax machine, a modem, and other devices is a feasible and cost-effective plan for today's small business. PC LAN Labs evaluates 15 fax line managers that help make a difficult balancing act look easy.

Many people do business in small offices these days. Plenty of effective organizations employ only two or three people, and people who work in large offices often maintain a small office at home.

No matter how well you plan an office, the question of how to provide multiple telephone lines is likely to come up. Installing an additional phone line in a corporate setting often involves simply attaching another instrument to the PBX. But balancing the needs of voice phone lines, fax machines, and modems in a small organization can create headaches and high monthly costs.

What can handle this balancing act and keep your business running smoothly and productively in its communications? Fax line managers—or, more specifically, fax/data/voice line managers—are the answer. These products, which often cost less than $300, field incoming calls made to a *single* phone line and route them to the appropriate device without disrupting your office routine.

In this article, PC LAN Labs evaluates 15 fax line managers representing a cross section of the market: 14 hardware solutions and 1 software package. Our reviews and Summary of Features table will detail the many architectural differences among these products.

by Frank J. Derfler Jr., and R. Dennis Boatner

GRAPHIC ILLUSTRATION: GARY W. KAPLOW

WHO—OR WHAT—ANSWERS

If your business has only one incoming telephone line, you are likely to face the problem of handling both voice and incoming fax calls. Voice calls are your lifeblood, but faxed documents are becoming a modern necessity, too. When you try to use a phone and fax machine on the same line, you face the dilemma of deciding whether to answer the phone or let the fax machine pick it up.

When you try to use a phone and fax machine on the same line, you have to decide whether to answer the phone or let the fax machine pick up.

To make matters worse, human callers become very frustrated when they receive a dual-tone burst from a modem instead of a friendly voice. With the differences in signaling patterns, there is normally no simple way to route incoming fax, modem, and voice calls.

If you install another phone line for the fax machine, you have another monthly bill. Since the cost of installation and annual service for a dedicated business phone line ranges from $343 in San Francisco to $613 in New York, most home users or small businesses need an alternative means of handling incoming calls. Even if you can justify the expense of another line, you still face the cost and difficulty of pulling more wires through the walls.

The problem of when and how to answer the phone becomes more complex when you add an auto-answer modem to your PC. You can install an auto-answer modem and a fax machine on the same phone line, but the two operate in exactly opposite ways during initial contact.

The calling fax machine generally sends a tone to get the attention of the device it is calling. As fax machines become more popular, more and more people have endured the annoyance of answering a misdialed call that begins with dead silence and follows with a shrill extended beep—the sound of a fax machine looking for a mate.

Calling modems, by contrast, are silent. The answering modem sends a dual-tone signal, indicating its readiness, and the calling modem replies. Until they are greeted, human callers are usually silent as well, which further complicates matters at the receiving end.

FOUR CATEGORIES

To address these challenges, the basic fax line manager has evolved into a complex assortment of diverse products. We can group these line managers into four categories. While these groupings are not set by any standard, several companies in the industry use the same classification scheme.

Type I devices answer calls with message and tone-detection capabilities. A personalized, prerecorded digitized voice instructs callers on navigating around the call-routing system. Here is a typical greeting: "You have reached ABC Company. To send a fax, wait for the tone. To speak to someone, please press '1.' Thank you." The system then awaits your response.

The length of the greeting is normally between 10 and 30 seconds. Type I switches, with varying options, usually cost $250 to $400. Most include barge-in protection, two or three ports for devices, and the ability to handle both single- and multiple-line systems.

A Type II device answers and analyzes incoming calls. After answering a call, this type of line manager listens for a fax calling tone, known in the industry as a CNG tone. That tone modulates at 1,100 Hz, which is very distinctive from other telephone sounds. This type of device does not play a voice message first; instead, it sends a simulated ringing tone or "phantom ringback" to the calling party, so that a human caller still hears the phone ringing while the line manager listens for the CNG tone.

Thus, the Type II device detects whether the incoming call comes from a fax machine, since fax machines start sending the CNG tone immediately after they dial.

Still, since both human callers and modems stay silent during the ring, the line manager has no way of distinguishing one from the other. If you use a Type II device to differentiate between modem and fax calls, modem callers must take some special steps.

Modem callers signal their identity to Type II line managers by sending addi-

FAX LINE MANAGERS: SUITABILITY TO TASK

Many companies are vying for your attention with fax line management products, and these products offer a diversity of capabilities. Making an unwise purchase can disrupt office communications and even hurt your organization's professional image. Our Suitability to Task boxes can help you in your selection.

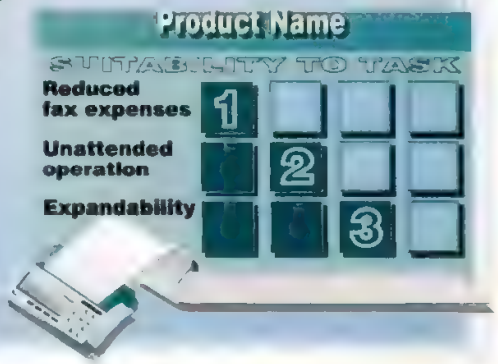
In these boxes, we use a scale of 0 to 4 for our ratings: 0—completely unsuitable for the task, 1—not very well suited to the task, 2—good, 3—very good, 4—excellent for the task.

THE TASKS

We are rating each metering product according to its usefulness in three areas. The first rating, **Reduced fax expenses,** assesses the product's ability to screen out junk faxes, thus reducing operating expenses (especially for fax paper) and the amount of time your phone line is occupied.

The second measure, **Unattended operation,** rates how much freedom the caller has when using a fax line manager. The caller may be notified to take steps before calling—for instance, by modifying the modem's initialization string. Or else, the caller could be given instructions online, say, in the form of an answering-machine message that tells the caller to dial "1" to send a fax on completion of its message. This differs from the procedure used by Type I line-sharing devices, which deliver a greeting message to every caller.

The last rating, **Expandability,** describes the ease with which the product lets you add more devices later—such as a fax machine or board, additional telephone extensions, an answering machine, a modem, or an auxiliary device.



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CIRCLE 377 ON READER SERVICE CARD

tional dialing tones. Since calling modems already generate dual-tone multifrequency (DTMF) tones for dialing, the caller simply puts a few more digits into the setup string. For example, you could instruct your modem to follow the code ATDT 5551212,,4,4. The ATDT command tells the modem to use tone dialing. The commas after the phone number tells the modem to pause, send the tones for a 4, pause, and send the 4 again. The line manager detects the DTMF 4 and connects the incoming line to the modem. If it doesn't detect an incoming fax's CNG tone or a modem's DTMF tone, the line manager connects the incoming call to the voice phone, which it rings with its internal ringer.

Unlike the Type II device, the Type III line manager does not answer the call. Rather, it listens for a CNG tone or a DTMF tone access code *after* the call is answered by a person or an answering machine. It then does any routing that is necessary.

The Type IV line manager uses the latest technology available from the phone company. You pay the phone company a monthly fee, usually $5 to $7, for each of several lines you are attaching to your primary line.

This new concept uses distinctive ringing, sorted at the phone company, for each line attached: A series of rings, long or short, identifies what kind of call is coming in. A fax call, for instance, may sound in your office as "ring-ring, ring-ring"; a call from a modem may produce longer, separate rings.

Type IV switches, which are set to recognize each distinctive ring, typically provide two or three ports for devices and sell from $79 to $200. Unfortunately, the distinctive-ring feature has some geographical restrictions. Check with your local phone company to determine the availability of this technology.

Our reviews cover only Type II and Type III switches, since these products are most appropriate for small or home-based businesses. Some companies failed to supply us with their products, for one reason or another; among them are Cobotyx Corp., Crosspoint, Delcor Technology, Globaltel, Peritek Corp., RM Systems, Taimou Electronics Co., Telemon, Transmar Enterprises, and UniSource. We do review one software product, *RemoteControl*, which converts your PC into a hardware switch to perform the same functions.

24-HOUR SECRETARY

Fax line managers effectively offer a 24-hour electronic telephone secretary, with efficient performance and a minimum of capital investment. These products use various techniques to overcome the difficulties of routing incoming calls to the appropriate fax, data, or voice telephone devices. They also have screening capabilities—such as preventing junk faxes from cluttering up your office or limiting access to your computer's database when others call your modem from a remote location.

The former feature, fax screening, may seem a relatively small point. Yet the expenses you could incur on wasted paper (at $20 to $30 per 100-sheet roll), along with the fact that your phone line is tied up while you receive useless drivel, make this an issue that needs more attention.

Most full-size line managers—the size of an external modem—mount on the wall or desktop. This size usually indicates more-sophisticated electronics and more options than smaller products offer.

All the devices in this review are external units. They form a hub for wires coming from the wall jack, modem, fax, voice phone, and answering machine. ATI Technologies announced, too late for our review, a product incorporating the features of most fax line managers into an internal PC fax/modem adapter board.

Line managers solve a troublesome problem. Sharing a telephone line among voice, modem, and fax devices isn't rocket science, but it seems that complex to many folks. The products reviewed here provide relatively simple line sharing and easy operation.

ACCO INTERNATIONAL INC.

ACCO 1-Line

ACCO International, best known for its office products, enters the fax-line-sharing arena with a basic switch, the ACCO 1-Line, Model #50505-50650. The 1-Line provides the basic fax/voice line manager functions, handling fax, phone, and answering-machine setups using a single phone line. Adding the ability to handle

EDITOR'S CHOICE

- **ASAP TF 555**
- **Automated Voice/Data Switch TB-150**

Since our review covers both Type II and III fax line managers, we thought it best to select one Editor's Choice from each of the two categories. On completion of PC LAN Labs' testing, however, two products stood out from the rest in the Type II category (answering and routing).

From the Type III category, no product offered the flexibility of configuration and operation that small businesses have come to expect of line managers.

The ASAP TF 555 switch, from Command Communications, gets our first nod for Editor's Choice. The ASAP's ability to screen junk fax calls, its accommodation of fax/modem/voice and answering machines, and its two-year warranty (with unlimited toll-free technical support) form a strong argument in favor of the pioneer of fax line managers. Although at $199.95 it is not the least expensive switch available, it offers more features per dollar than the others we tested.

Another Editor's Choice goes to Rainier Technologies Corp. for its $199.95 Automated Voice/Data Switch TB-150. Helping the product's case is the company's philosophy, "If it doesn't work all the time, it doesn't work at all." This is demonstrated by the product's features, including remote device access, distinctive fax ring, and 911 override. Its strong functionality, in fact, offsets the switch's one-year warranty and its inability to screen out junk fax calls.

Honorable mention goes to Electronic Modules' SmarterFax Switch. Priced at $249, the SmarterFax has the strongest extended warranty—a full five years—plus a good selection of fax-related products to complement an already vital product. Keep a close watch on this company: It's going places. ■

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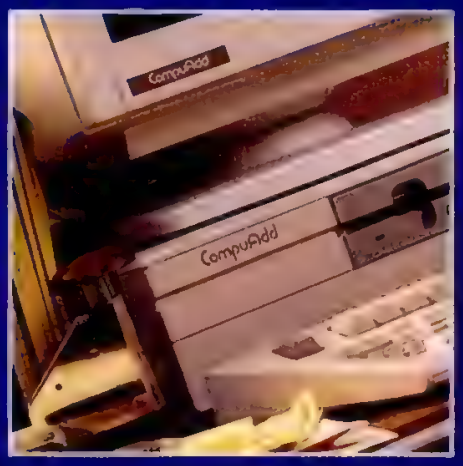

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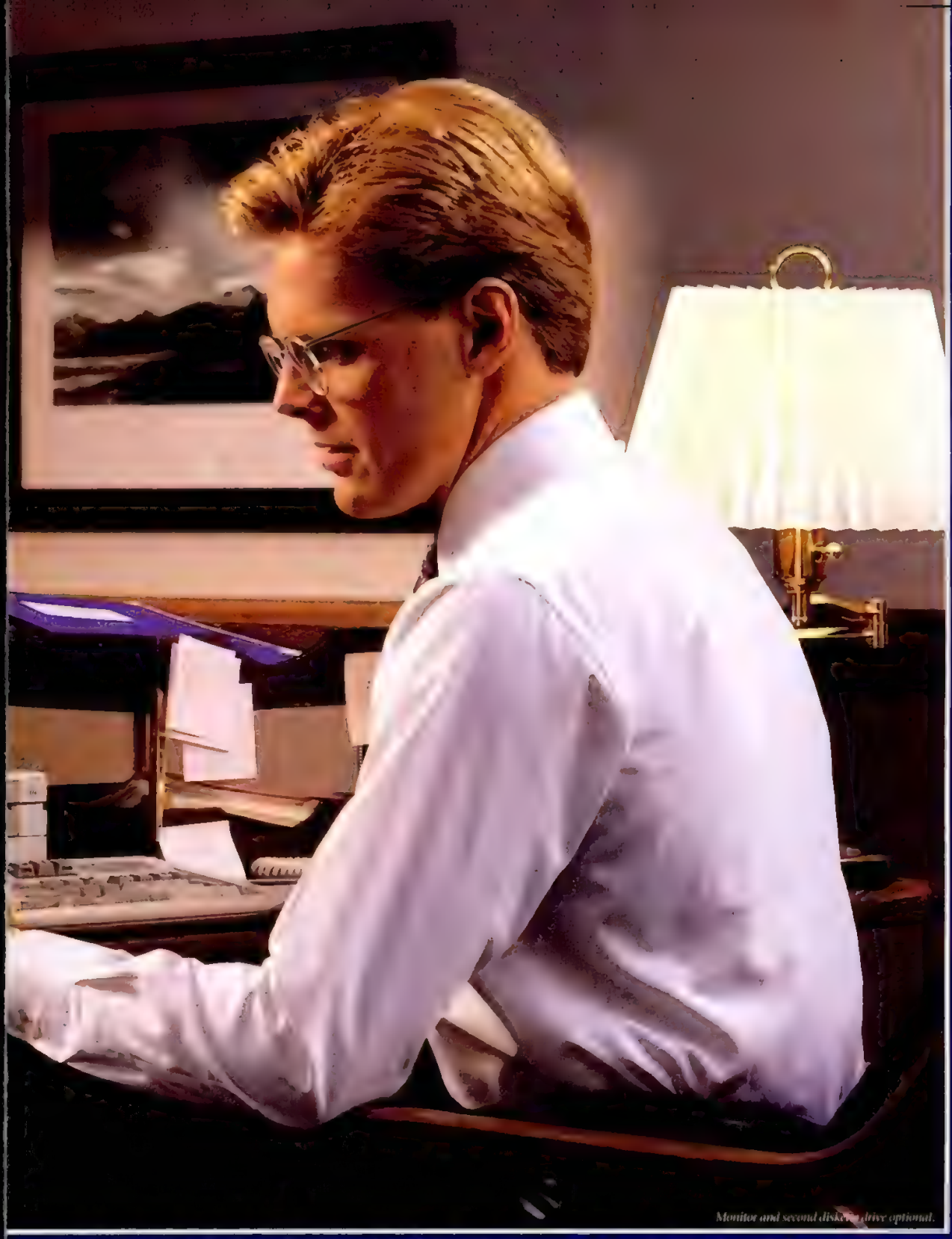

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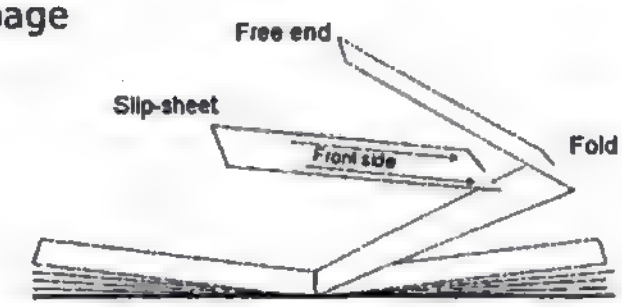

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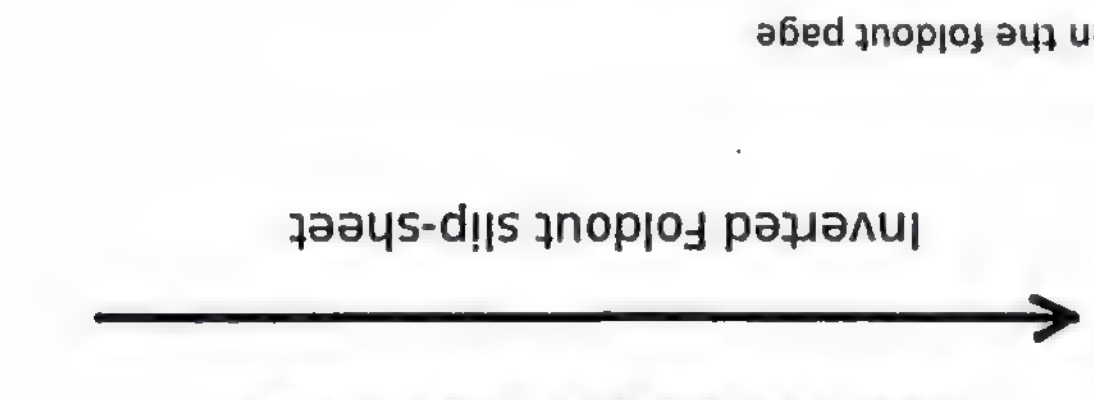
4. Close the page and slip-sheet



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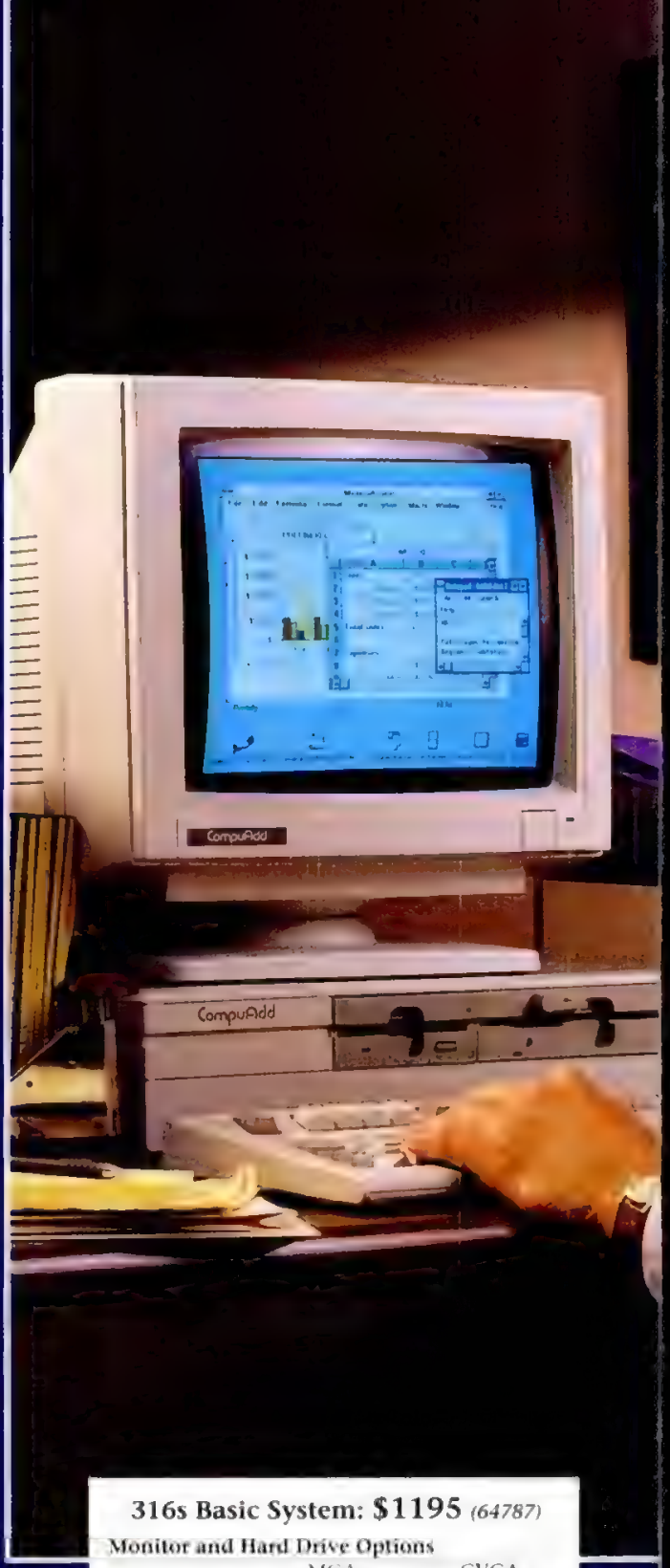

316s Basic System: $1195 *(64787)*

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	MGA	CVGA
40MB (28ms)	64788 - $1759	64793 - $2089
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110MB (19ms)	64790 - $2129	64795 - $2459

320s Basic System: $1395 *(66537)*

Monitor and Hard Drive Options

	MGA	CVGA
40MB (28ms)	66539 - $1959	66542 - $2289
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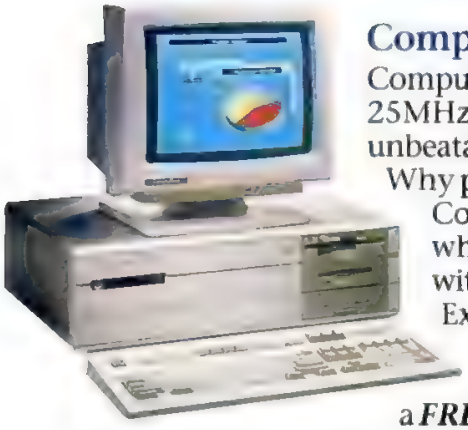

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- Dual diskette drive controller
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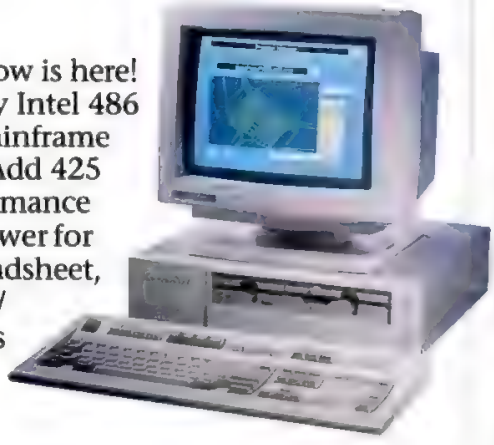

CompuAdd 425 Features:

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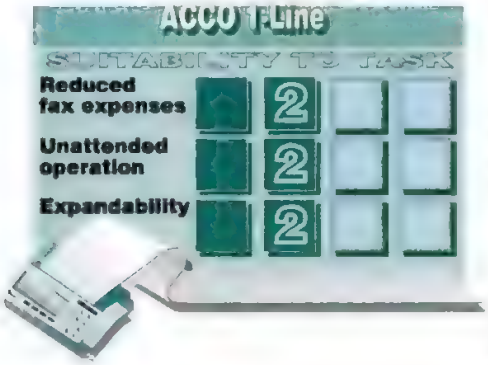
modem calls and screen faxes would make it more attractive to prospective buyers.

The product falls into the compact switch category, measuring 1.5 by 4.8 by 5.3 inches (HWD). It weighs only 1 pound and lists for $179, with a street price of about $139. While ACCO designed the package to work with a single phone line in the home or office, you can also fit it snugly into a PBX or a Key system by



installing it on the last line of either of these systems.

The 1-Line's manual has good instructions and diagrams, making installation simple. You merely have to plug your existing phone line into the switch, then hook your fax machine and answering machine into it. The 1-Line uses standard labels for the connections.

Since the 1-Line only listens to incoming calls but doesn't answer them, it does not need a phantom ringback. It uses automatic fax detection, which relies on the originating fax to generate a CNG tone. If the fax doesn't send the tone (and some older models do not), the call defaults to the voice side of the switch after four rings. You can manually switch the call to the fax machine at any time.

BLOCKS OUT EXTENSIONS

If your office uses extension phones, the 1-Line must be installed after the PBX/Key or else it will block out the extensions. The switch cannot be installed on the line between the central office and the PBX/Key device.

And while the 1-Line is simple to operate, its design lacks features found in other devices in this price range. It lacks a telephone, a programmable ring delay for faxes, and the ability to screen junk fax calls and to handle modem calls. Furthermore, the 1-Line requires you to disable call waiting and set up your answering machine to answer before the fourth ring. These procedures prevent the call from rolling over to the fax machine.

The manufacturer warrants the ACCO 1-Line for only one year against defects in labor and workmanship, which is less than ideal. It does provide unlimited technical support and a toll-free number. The technical support department operates from 8:00 to 5:00 Eastern Standard Time; at other times the company's support lines are monitored by an answering machine, and calls are returned during working hours.

Since the 1-Line listens to incoming calls but doesn't answer them, it does not need a phantom ringback.

FACT FILE

ACCO 1-Line
ACCO International Inc., 770 S. ACCO Plaza, Wheeling, IL 60090-6070; (800) 222-6462.
List Price: Model #50505-50650, $179.
In Short: ACCO 1-Line provides the barest essentials among the voice/fax switches reviewed; in fact, it lacks features found in models that cost less. It handles no modem calls or remote polling of any auxiliary device, nor does it screen fax calls.

CIRCLE **426** ON READER SERVICE CARD

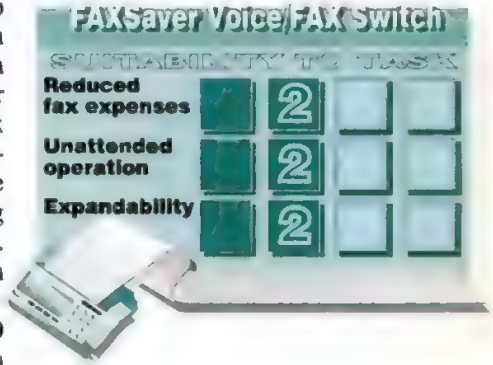
ADVANCED ELECTRONIC APPLICATIONS INC.

FAXSaver Voice/FAX Switch

A newcomer to the fax-line-sharing market, Advanced Electronic Applications offers a well-rounded product in its FAXSaver Voice/FAX Switch. Although the FAXSaver does offer some good features, its chances might be helped by more attention to modem users and fax screening, along with more flexibility in configuration.

The FAXSaver falls into the full-size switch category, measuring 2.5 by 7.5 by 8.5 inches and weighing 3.8 pounds. Its list price of $299, with street prices around $225, makes it one of the higher-priced switches tested.

Installation, as with most switches, was simple. The switch uses standard labels along with pictures above the label to assist you. The manual provides adequate instructions for single-line and PBX/Key wiring.



The FAXSaver uses call blocking, preventing a device that is not in use from accessing a line that is occupied. If you pick up the main phone or an extension while the line is busy, you hear a slight humming; this ensures completion of the call in progress. Another FAXSaver feature is the ability to transfer calls from the phone or answering machine to the fax machine. The pound key (#) is used to start the transfer, so either you or the caller can manually direct the incoming call.

ALERT-MODE OPERATION

The FAXSaver offers Alert Mode operating, which augments the unit's normal operation by letting it transfer fax calls automatically. When Alert Mode is activated, a green LED lights up on the front panel. The incoming greeting message is disabled, and a half-second ring signal is sent to your phone when a call comes in. If your phone doesn't ring, then a fax has arrived or is in process.

The FAXSaver automatically routes all calls to the telephone after five rings—or if power should fail. You can start the FAXSaver's call waiting feature after hearing the familiar line-tone

"beep." If you hear the CNG tone of an incoming fax, you direct it to the fax machine. The switch places you or the caller on hold while the fax is received. Afterwards, it automatically restores the original connection.

ANSWERING MODE

Not only does the product listen to the incoming call for a CNG tone, but you can also select answering mode, which presents the caller with a greeting message. The switch has the ability to handle a phone and a fax machine as well as an answering machine.

The FAXSaver's main shortcomings are that it doesn't handle modem features, and it has little flexibility; most of the values are preset at the factory. It doesn't use phantom ringback signals, nor does it screen for incoming junk faxes. The product works well with most answering machines on the market, but Advanced Electronic Applications has chosen to handle only phone/fax/answering-machine configurations now. This leaves out modem users.

AEA warrants the FAXSaver for only one year against defects in parts and workmanship. The company provides unlimited technical support, but you must pay for the call. Telephones are attended from 8:00 to 4:30 P.S.T., and no after-hours support is available.

FAXSaver Voice/FAX Switch
Advanced Electronic Applications Inc., P.O. Box 2180, Lynnwood, WA 98036; (206) 775-7373.
List Price: $299.
In Short: FAXSaver Voice/FAX Switch provides a well-rounded product for small-office environments that do not need a modem but do want fax screening. The switch has good features, and the company has a stable background in the electronics industry.

CIRCLE 427 ON READER SERVICE CARD

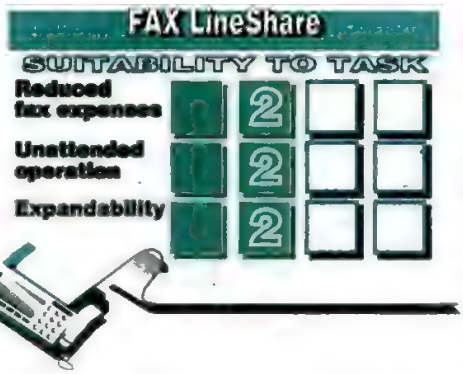
CALL MANAGEMENT PRODUCTS INC.

FAX LineShare

Call Management Products (CMP) has a commendable product in FAX LineShare, Version 2. The switch sports good design, but it lacks some of the features found in similar models costing less. In some areas it needs improvement if it is ever to attract a greater share of users in a changing market. More emphasis on modem security, combined with the addition of an AUX port and fax screening, would make it more attractive.

This $199 switch is compact, with dimensions of 1.8 by 4.5 by 5.5 inches. It weighs only 1 pound.

The FAX LineShare (FLS) automatically answers incoming calls and listens for a fax prefix or a CNG tone to identify the call as a fax transmission. The FLS's line exclusion feature locks out voice users during fax calls, and locks out faxes if the line is accessed first by a voice caller.

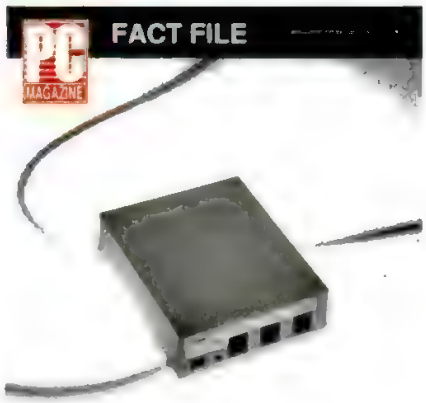


The package works on both single and PBX or Key wiring systems. While the FLS handles fax/modem/phone lines and an answering machine, it does not have an AUX port option. This limits its ability to access remote locations, although you can purchase a low-cost splitter to get around the problem.

EASY INSTALLATION

FLS installation requires only plugging the RJ-11 cables into the proper ports with easy-to-understand labeling. The professional-quality manual smoothly guides you through the process.

The FLS can ring up to seven telephones, using a phantom ringback; the caller hears only a ringing and is unaware of call routing before the connection is made. The switch generates a fast busy-signal tone when a fax or voice caller attempts to use the line while another device is using it.



FAX LineShare
Call Management Products Inc., 555 Burbank St., Suite Q, Broomfield, CO 80020; (800) 245-9933.
List Price: Version 2, $199. RingRite, $79.95.
In Short: Although in some ways rich with functions, FAX LineShare lacks important features such as fax screening and modem security. It also needs an AUX port to allow the user access to detached workgroup monitoring and other remote functions.

CIRCLE 428 ON READER SERVICE CARD

This product handles approximately 80 percent of all fax calls automatically, in a way that is transparent to both local and long-distance callers. Incoming calls from older fax machines are routed to the fax connection when the caller dials "33" on a Touch-tone phone or "3" on a rotary-dial phone. A user-programmable ring count will delay rollover of unattended calls to the fax. The FLS can also ask the departing user to take the phone off the hook, thus forcing the unit to relay all calls directly to the fax machine.

The FLS allows you to program ring counts for your TAD (answering machine) and for the rollover to the fax machine. You can have a TAD-to-fax transfer, so that instructions on the answering machine direct the caller through the proper procedure.

The switch comes with a less-than-generous one-year warranty on parts and labor, along with unlimited technical support and a toll-free number. The technical staff works from 8:00 to 5:00 M.S.T. and also provides 24-hour support by monitoring an answering machine.

Another CMP offering is RingRite, a $79.95 Type IV product that uses a dis-

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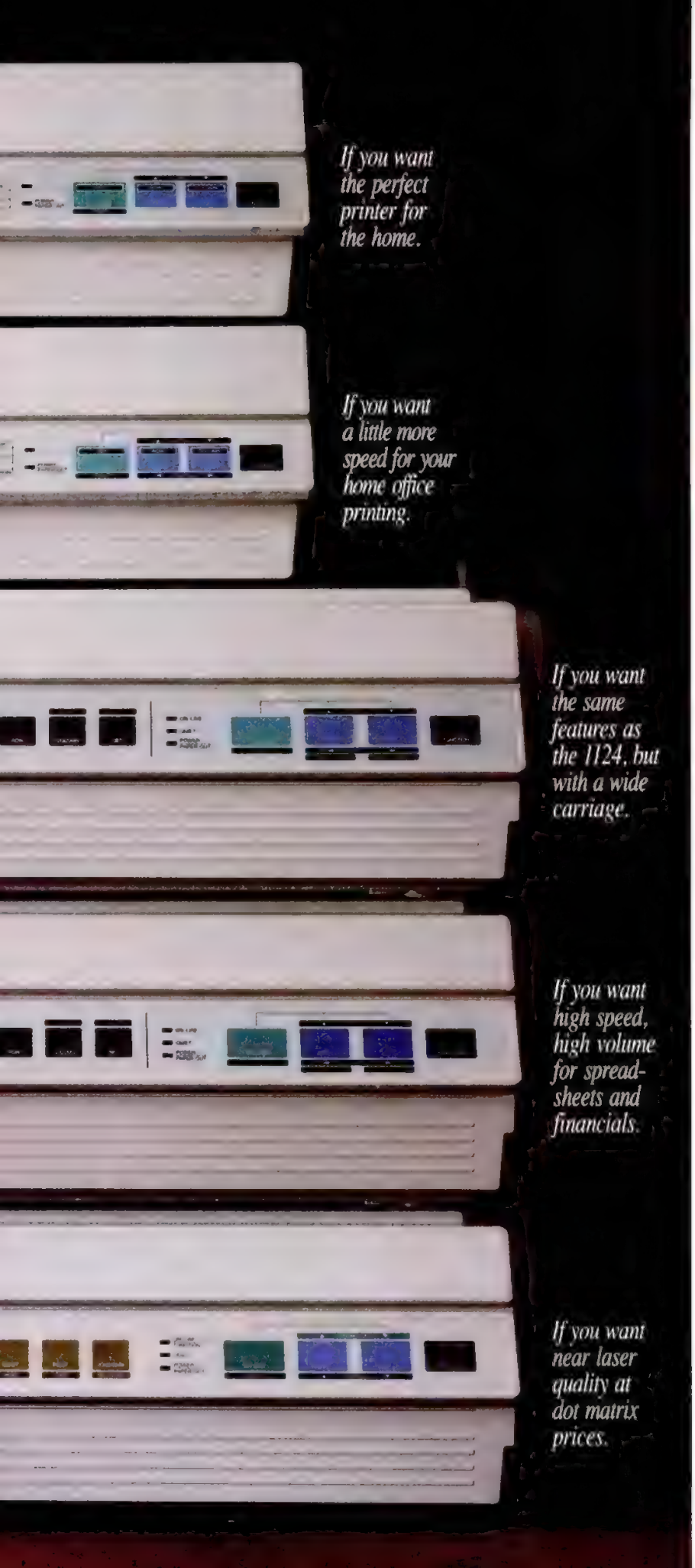

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CIRCLE 138 ON READER SERVICE CARD

DMF-PC

tinctive ring concept to add three additional lines to your existing phone line at a monthly service charge of approximately $5. Check with your local phone company before installing it, as geographical restrictions apply.

COMMAND COMMUNICATIONS INC.
ASAP TF 555

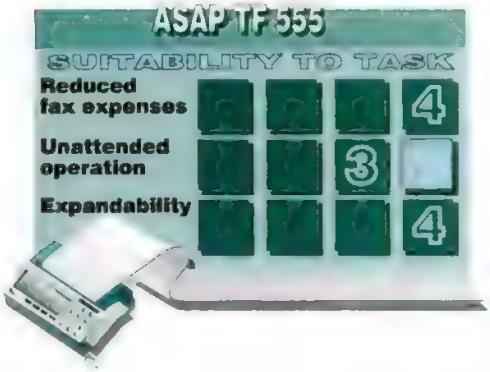
Command Communications, pioneer of the fax switch device, has a winner in its ASAP (Automatic Switching And Processing) TF 555. This switch monitors fax/modem/voice devices and answering machines on single, PBX, or Key systems. It can screen your fax calls and limit access to your computer system's modem by means of access codes. The combination of a low installation cost and a complete set of features makes the ASAP TF 555 one of the best switching values.

The TF 555 packs its flexibility and electronics into a full-sized case that measures 1.8 by 5.8 by 6 inches and weighs 1.8 pounds. It sells for $199.95, which translates to a street price of about $170.

The TF 555's valuable features include the ability to screen out junk fax calls. It uses four-digit security to protect your database and voice mail. Unlike other switches tested, the TF 555 defaults to the answering machine rather than the fax machine; this allows your caller the option of leaving a voice message after completing a fax transmission.

WELL-WRITTEN DOCUMENTATION

The product's well-written, well-illustrated documentation makes installation easy. The TF 555 is also well labeled. These factors, combined with the product's own design, can represent an installation savings of $80 to $125. And it operates from any telephone outlet, permitting total control from any local or extension phone.



You can protect your fax and modem from unauthorized entry using the TF 555's programmable four-digit access codes, which an authorized user inputs on a Touch-tone keypad. A programmable ring delay determines how many times the phone will ring before the switch answers.

Likewise, the package incorporates a telephone answering device (TAD) ring count option, which programs the number of times the switch will ring your TAD and phone after answering a call. If it detects no answer at either port within the specified number of rings, it routes the call to the fax port.

The TF 555 also supports a fax/auxiliary device ring count, which determines the number of times it will ring the device before hanging up the line. It implements automatic ring detection, ensuring automatic transfer of calls to the fax port even after business hours. An open-line notification feature verifies that a line is clear after someone picks up an extension phone while the fax or AUX port is in use.

The extension detection feature enables the TF 555 to detect a phone that is not connected directly to the TAD/phone port, should it attempt to answer a call while the device is ringing that port. The automatic fax detection feature lets the product automatically transfer any call using a CNG tone signal to the fax port. Another feature allows automatic reverse modem detection; this transfers a call from a computer using a reverse modem carrier signal to the AUX port.

An automatic TAD-to-fax feature transfers the call to the fax port after the TAD has answered it; thus, someone can leave a voice message and a fax document without making two calls. The package uses a phantom ringback signal, making its operation transparent to the caller; the caller hears only a simulated ring while the switch analyzes and processes the call.

RELATED PRODUCTS

Command Communications also sells the ASAP TF 505 switch. This product handles fax/voice/data and an answering machine with fewer features than the TF 555; it requires professional installation and lists for $179.95, with a street price of about $130. Another model, the Eliminator, handles only fax/phone or modem/phone configurations and lists for $119.95, with a street price of $100. Both models carry a warranty period of only one year.

Command Communications plans to release a new ComSwitch 200 by the time you read this; it will sell for $99.95 list, with a street price of $70. Designed for only fax/phone/TAD operation, the ComSwitch 200 will carry a bare 90-day warranty.

The ASAP TF 555 comes with a full two-year warranty, along with toll-free technical support from 8:00 to 8:00 M.S.T.

FACT FILE
EDITOR'S CHOICE

ASAP TF 555
Command Communications Inc., 10800 East Bethany Dr., #300, Aurora, CO 80014; (303) 750-6434.
List Price: $199.95.
In Short: Command Communications may have struck gold with its ASAP TF 555 switch. The hard-to-beat product can screen fax calls and limit access to your modem, and you can install it without professional help.

CIRCLE 429 ON READER SERVICE CARD

CREST INDUSTRIES INC.
AutoFax Switch

Crest Industries throws its hat into the fax-line-sharing market with the AutoFax Switch; the first shipment rolled out of the warehouse this past July. The product's competitive pricing ($125), combined with good switch flexibility and customer support, provides small businesses with a cost-effective solution to a growing problem. Crest's next step should be to consider fax screening and an additional port for a separate answering machine or AUX devices.

This Type II device is a full-sized switch for single-line or PBX/Key wiring configurations; it measures 2.2 by 6.4 by 9.5 inches and weighs 2 pounds. Crest suggests that you get professional help to

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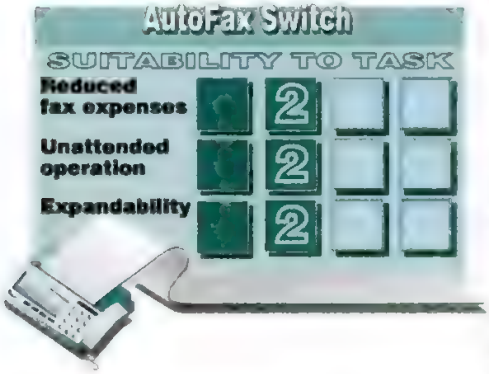
CIRCLE 226 ON READER SERVICE CARD

install the AutoFax on PBX or Key systems; this can cost you up to $125 extra.

We completed the installation easily with the well-written manual. The switch uses standard-terminology labeling, and Crest offers an AutoFax installation kit for use on modular hookups to speed the single-line process. The kit sells for $17 and includes a line splitter, extra cabling, and instructions.

The AutoFax intercepts incoming calls automatically on the first ring and routes them to the proper device. It defaults all calls to the fax device, should they go



unanswered. AutoFax also handles three devices in combination—for instance, a phone, fax, and modem or answering machine—if you use a line splitter or an RJ-14 coupler.

After answering and analyzing a call, the switch forwards it before the second ring. Like the phone company, the AutoFax rings five times on either the fax or phone port. While this takes place, the caller hears the phantom ringback until the AutoFax completes the call. If an incoming fax call doesn't generate a CNG tone, the AutoFax allows both the sender and receiver the option of directing the call manually to the fax device. The AutoFax also allows callers to access the modem by pressing the star button (*) after the first ring.

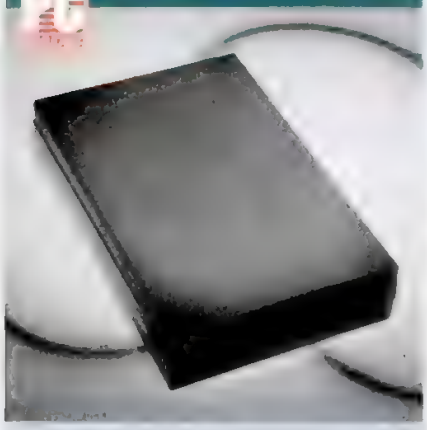
LINE EXCLUSION

Although the AutoFax does not offer ring delay or a TAD ring counter, it does provide line exclusion for all extension phones. This allows completion of each fax with its data intact. If you pick up the phone during a fax transmission, you hear dead silence.

The AutoFax does not screen for incoming junk faxes and does not require special codes for access to the modem port. You do have the flexibility of polling remote locations, even though the AutoFax does not have an AUX port.

Crest supplies a two-year warranty against defects in materials and workmanship. The company provides technical support via a toll-free number from 7:30 to 4:00 P.S.T., and 24-hour call monitoring.

FACT FILE



AutoFax Switch
Crest Industries Inc., 201 Frontage Road North, Suite B, Pacific, WA 98047; 800/452-7378, (206) 735-6000.
List Price: $125.
In Short: While a newcomer to fax line managers, Crest Industries nevertheless provides good flexibility and competitive pricing in the AutoFax Switch. What the product needs next is fax screening and additional modem options.

CIRCLE 542 ON READER SERVICE CARD

ELECTRONIC MODULES INC.
SmarterFax Switch

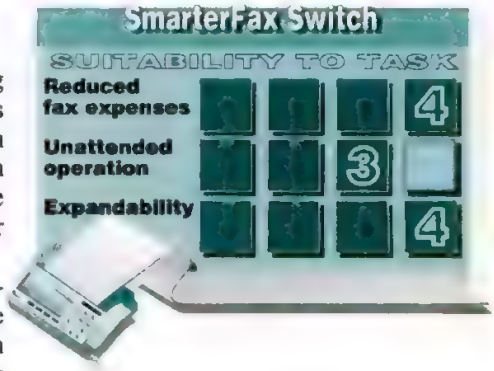
Electronic Modules Inc. (EMI) seems to have a handle on the challenges that face fax-line-sharing devices, earning a niche in the ever-changing marketplace. SmarterFax Switch addresses the shortcomings of many similar devices, offering fax screening and modem security. The product's flexibility, combined with the accessory products available and the up-to-five-year warranty, convinces us that EMI is a company worth watching.

The manufacturer recently lowered the list price of the SmarterFax to $249. It uses a full-sized case measuring 3 by 7.5 by 7 inches and weighing 5 pounds.

The SmarterFax can handle three devices at the same time, including a telephone and answering machine, a fax machine or board, and a modem. The SmarterFax features a voice message capability, with which you can deliver a 14-second message about your company and instructions on how to access the fax machine if it is unattended.

You can deactivate this function and allow the call to proceed; thus the EMI unit is both a passive and an active line-managing device.

This switch's flexibility speaks for itself. Installation is simple with the easy-to-understand manual and labeling. The documentation covers all possible hookups, with appropriate wiring for each setup.



ACCESSORY FEATURES

The SmarterFax comes loaded with a deluge of accessory features. You can access remote polling devices like a point-of-sale terminal, a credit authorization terminal, or a remote tank sensing unit, just to name a few. The SmarterFax screens junk faxes and uses programmable security codes to limit access to your database.

The product includes a programmable ring delay—with up to 31 rings—and includes TAD ring counting and a programmable fax counter. It has automatic ring detection, extension detection, fax detection, and reverse modem detection. If you operate the SmarterFax in the Voice Answer mode, it answers on the first ring; in the Passive mode, it does not activate a phantom ringback.

The SmarterFax also offers a TAD-to-fax transfer feature. All fax calls not producing a CNG tone can be directed by either the caller or the end user, depending on the unit's mode of operation.

EMI offers other products related to its fax-line-sharing devices. The SmarterFax Fax Expander ($499) provides an upgrade to your existing fax device. The SmarterFax Mailbox Manager ($899) allows fax forwarding for up to 100 mailboxes; the contents remain secure until the owner of the box, using a custom code, chooses to

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WHAT SERVICE!

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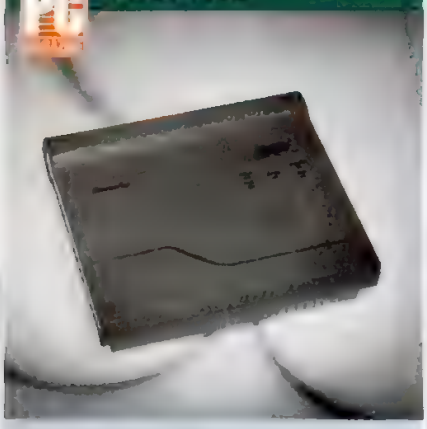
CIRCLE 470 ON READER SERVICE CARD

FACT FILE



SmarterFax Switch
Electronic Modules Inc., 10410 Vista Park Rd., Dallas, TX 75238; (214) 340-6789.
List Price: $249. SmarterFax Fax Expander, $499; SmarterFax Mailbox Manager, $899.
In Short: SmarterFax has made innovative inroads in the market by addressing the need for fax screening, providing modem security, and interfacing with network systems. EMI also offers supporting products to round out a complete line.

CIRCLE 543 ON READER SERVICE CARD

view and/or delete them.

EMI provides a standard parts-and-labor warranty of just one year for all products, along with telephone technical support from 8:00 to 5:00 C.S.T. and an answering machine after hours. The company also offers an additional four-year warranty and other service options in a package that ranges from $100 for the SmarterFax Switch to $200 for the Mailbox Manager. This package includes access to EMI's "Incredible Service Plan Customer Hotline," plus a guaranteed 24-hour repair time for your product, free enhancements and updates, and other benefits.

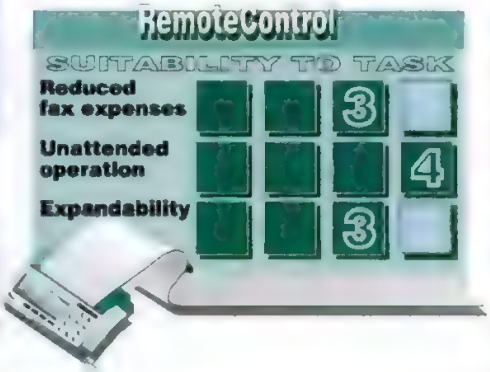
ELECTRONIC TECHNOLOGIES
RemoteControl

In today's get-what-you-can-while-you-can market, someone dares to stand out from the crowd. Electronic Technologies' founder, Charles Eglinton, is offering *RemoteControl*, a unique new approach to the problem of multiple devices accessing a single phone line. This software program allows users to share a modem, fax, and answering machine on a single incoming phone line for the unheard-of price of $35. While this solution may not work for you, it merits definite consideration solely on the strength of its pricing.

RemoteControl comes in both 5.25-inch and 3.5-inch formats. Installation is as easy to take as the price is. The menu-driven program prompts you to gather the necessary information to make it conform to your system; it even explains how to set up each device to ensure proper operation.

RemoteControl basically works the way most fax-line-sharing devices do; the program requires merely a single ring of the phone to bring it on-line. You can have a modem, a fax board, an answering machine, and a pager all working without your callers knowing anything about your system—unless you want them to know.

Instruct your callers to send a fax by calling your number, letting the phone ring twice, and then hanging up. They immediately repeat the process but this



time send your fax documents. To access the answering machine, they just let the phone ring.

RemoteControl does not use ring delay. It does use automatic ring detection with built-in security for modem and fax devices; this eliminates junk faxes and unauthorized modem access. Electronic Technologies designed *RemoteControl* to work only with single-line systems, and it will not operate on PBX or Key setups. It will allow polling remote devices such as your CAT, a POS terminal, or even a remote tank sensing unit.

REMOTE DATABASE ACCESS

If you want to access your database while away from the office, simply boot your computer with the disk you will have created during installation. When you install the program, you select the devices you want to have answering and the ring count for each device. Normally one ring allows access to the modem port, two rings gets you to the fax machine or board, and three rings starts your answering

FACT FILE

RemoteControl
Electronic Technologies, 3985 S. Rochester Rd., Suite H, Rochester, MI 48307; (800) 325-7379.
List Price: $35.
Requires: 512K RAM, 700K disk space on hard or floppy disk, DOS 2.1 or later.
In Short: The only software product reviewed here, *Remote Control* has taken an unusual, cost-effective approach to handling line-sharing problems. While it may not be the right solution for your specific needs, you can't go too far wrong for $35.

CIRCLE 544 ON READER SERVICE CARD

machine (and a pager if you have one).

What if it's quitting time but you have to take some work home? Or suppose you get home and find out that you left some of the files you need on the office computer? No need to drive back to the office; just dial your office number and let the phone ring once to start the modem port. If you call back within 2 minutes, you can get the files you need. It isn't foolproof security, but it should be fine for most uses.

Electronic Technologies warranties its software for one year. The company also provides unlimited technical support by way of a support line operated from 9:00 to 5:00 C.S.T. and a 24-hour BBS on CompuServe's EasyPlex.

HIGH-TECH RESOURCES INC.
The Switch

High-Tech Resources' latest release—The Switch, Model A-5—crams a lot of features into a compact case. The Switch incorporates state-of-the-art circuitry and features not found in other switches costing almost twice as much. Its best feature is the ability to function within a network environment with a variety of devices; this is a real plus. Unfortunately, it also lacks fax and modem screening. The addition of these two features could make it one of the best products on the market.

With dimensions of 1.3 by 2.6 by 4.5 inches and a weight of only 1 pound, this small package offers plenty for just $149. It handles a phone, fax, and modem using only a single line.

Installation is simple with concise labeling and an adequate manual, though

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The computing world is a changing place. That's why we're introducing a totally new family of universal removable storage products that can be easily attached to today's newest systems. Our Parallel Port Interface even lets you attach a Bernoulli to computers without an expansion slot or SCSI port. Now that's versatility.

Bernoulli® brought worry-free storage to everyone—now you can take it everywhere. Our new Transportable packs all the power and data security of our 44MB removable

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Disk Configuration –
- 5.25" half-height 44MB

Drive Configurations –
- single or dual (internal or external)
- battery-powered portable.

Effective Access Time –
- 22 msec

Disk Shock –
- 1,000 Gs

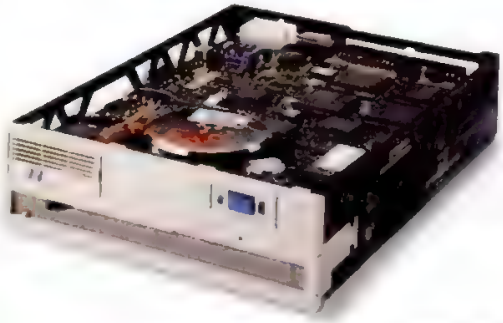
Mean Time Between Failure –
- 60,000 hrs.

Compatibility –
- DOS, PC & PS/2®
- Macintosh®, OS/2®
- Windows®, NetWare®, UNIX®

Installed Base –
- 625,000 drives
- 3,750,000 disks

InfoWorld Product of the Year 1987

BERNOULLI MEANS SECURITY FOR YOUR DATA

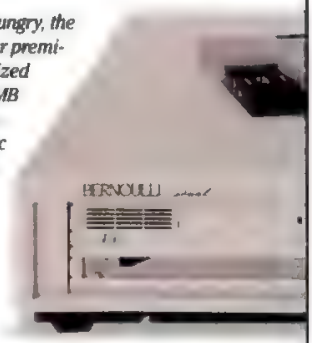


When space allows, the Bernoulli Insider fits neatly into leading PC and PS/2 computers. As a total storage solution, it's much better than a hard disk plus tape because you get the benefits of both, along with the unlimited data growth and security of removable storage.

Bernoulli's removable disks are the most rugged available. And we back that up with an unheard-of 5-year Gold Standard Limited Warranty.

BERNOULLI GOLD STANDARD LIMITED WARRANTY · FIVE YEAR

For the truly power hungry, the Bernoulli Dual is your premium choice. It's optimized to bring you up to 89MB of removable on-line storage with a 22msec effective access time. And it makes disk-to-disk copies in under three minutes. That's performance for the real world.



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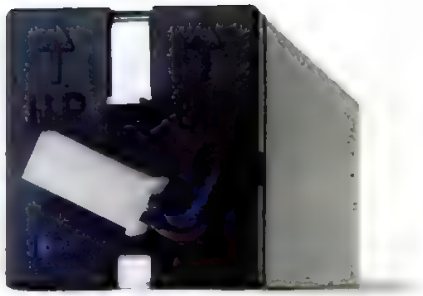
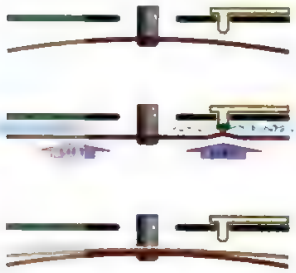
ERNOULLI.
TIME. ANY PLACE.



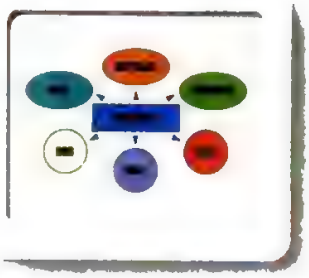
What if you're caught someplace with a lot of work to do and no outlets to be found? No problem. Each removable battery in the Bernoulli Portable provides approximately two hours of operation. And you can run it off the AC adapter while the battery is charging.

disk drive into a convenient, AC-powered unit. And the price? We've greatly reduced it on all Bernoulli products (up to 22 percent), so they're more affordable than ever

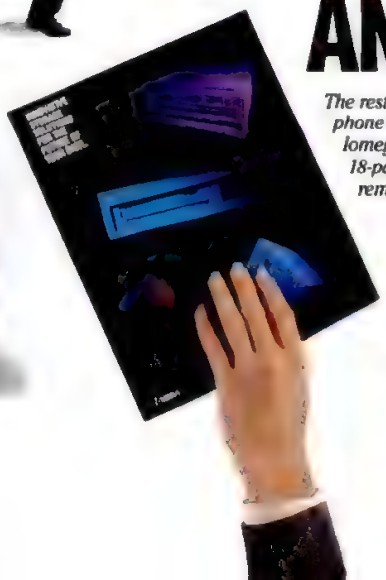


You don't want to entrust your data to anything you have to pamper. That's the beauty of Bernoulli. Its patented design spins a flexible disk at high speed, drawing it toward the head. Should your system encounter a bump, air impurity, or power-loss, the flexible disk simply falls away from the head. The result? Hard-disk performance without the risks.

With all the computing choices out there, the last thing you need is a storage device that limits your options. Our new universality is a unique innovation which lets you easily attach the same Bernoulli to most any system, giving your data (and budget) protection for tomorrow.



Who says you can't take it with you? The new Transportable and Portable were specifically designed for a shrinking world on the move. But just because they're lightweight doesn't mean they're light on performance. Bernoulli implements the latest drive enhancements to help you keep pace with your busy schedule.



ANY QUESTIONS?

The rest of the Bernoulli story—including our new, lower prices—is just a phone call away. Dial 1-800-777-6133 to find out the location of your nearest Iomega reseller, and we'll also rush you a free copy of this limited-edition, 18-page brochure. It's packed with everything you need to know about removable data storage. Any way you like it.

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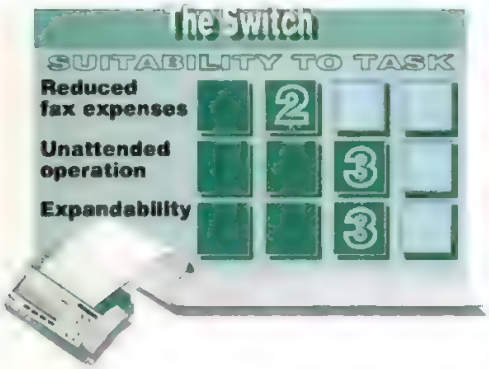
STORAGE SOLUTIONS BY IOMEGA

CIRCLE 378 ON READER SERVICE CARD

the latter could use more illustrations to help the user along. KwikLink, a coupler supplied at no extra charge, allows you to install your fax or modem into the nearest wall outlet.

SWITCH OPERATION

The Switch answers on the first ring, responding with a phantom ringback tone



that closely matches the normal phone ring. It works with both tone and pulse phones, and it has the flexibility of working with or without an answering machine. Either the calling party or the person called can manually switch to the answering machine by using Calling Party Control, an access code entered from the telephone keypad.

The Switch installs on either a single-line or a multiline phone system, like a PBX or Key system. Installing it without using KwikLink allows any extension phone to ring only once. If a user picks up an extension, he will hear the switch continuing to ring in the background. The user can enter a number on the telephone keypad, causing The Switch to route the call to that extension.

The Switch features automatic fax detection; if the calling fax doesn't produce the standard 1,100-Hz CNG tone, either the caller or the user can switch the call manually to the fax machine. Another feature gives older fax machines the ability to generate a CNG tone once linked to The Switch.

The product can access many remote devices, such as a credit authorization terminal (CAT) or an order-taking system. It also lets you program the default ring counts for the fax and modem. The Switch has a battery backup for ring count memory as well as LEDs to show the in-use condition of each port. And it has reverse modem detection and call blocking. Unfortunately, The Switch does not have the ability to screen junk faxes, limit modem access, or offer automatic TAD-to-fax transfer.

High-Tech Resources offers a mere one-year warranty on parts and labor. It provides a toll-free number to answer technical questions, from 8:00 to 6:00 E.S.T., and accepts calls after hours via an answering machine.

High-Tech also manufactures The Switch, Model A-1 ($119), with dimensions close to those of the Model A-5. The A-1 handles either a phone/fax or phone/modem setup.

FACT FILE

The Switch
High-Tech Resources Inc., 230 Main St., Ellsworth, ME 04605; (800) 422-2832.
List Price: Model A-5, $149.
In Short: Model A-5 combines state-of-the-art technology with a compact size in offering a cost-effective way of using limited resources. It is one of the few switching devices specifically designed for a network environment, although High-Tech needs to address modem screening in its next release.

CIRCLE 545 ON READER SERVICE CARD

LYNX AUTOMATION INC.

ExtraLine

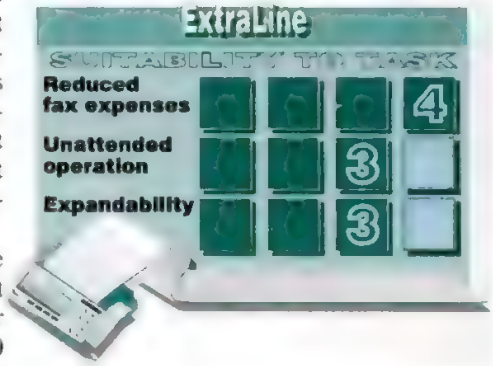
Lynx Automation provides interesting features in its compact-case switch, the ExtraLine. The company's newest product includes features such as distinctive ringing and fax screening. Overall, it's a good product with competitive pricing ($199). If Lynx paid the same attention to modems as to faxes and phones, it might enjoy a greater share of the market.

Lynx designed the ExtraLine to work as a voice/fax or fax/modem switch; the former version can also accommodate an answering machine. The Extra-Line will work with either single- or dual-line systems and Key or PBX setups. It packs a lot of features inside a case measuring 2.5 by 6.1 by 6.3 inches. The unit weighs 2 pounds and comes with its own power supply.

Installation is easy. The manual offers good diagrams and complete, detailed instructions on each setup option. The ExtraLine's ports are labeled to speed installation.

You can install it in series or parallel, the latter working only with Touch-tone extension phones. Installation on PBX or Key systems requires placing the Extra-Line ahead of the existing phone switch, just as with the ACCO 1-Line.

The ExtraLine employs user-programmable tone codes for access to the fax port; this feature allows you to screen out junk faxes from the pool of incoming fax calls. Among other features, the switch uses a programmable ring delay, auto-



matic fax detection, and open-line notification. Call blocking, manual routing of calls from older fax machines, and automatic TAD-to-fax transfer are part of the package, too.

While the ExtraLine switch doesn't place as much emphasis on modem access as on fax calls, the fax/modem version of the product does allow modem access. The ExtraLine does not use reverse modem detection or access codes to guard your database.

The ExtraLine boasts two-stage notch filtering and advanced error-correcting software to eliminate false detection of either CNG or Touch-tone codes. The product uses two LEDs and includes great surge suppression, which is a real plus. This is implemented through a built-in transorber (like an electronic shock absorber), which passes the charge to a gas tube for dispersal.

The ExtraLine has you use DIP switches to program its settings, unlike line managers that use either a battery

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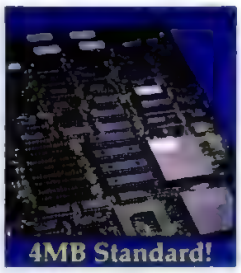
Our Complete 486/25 System only $5645

- **16ms High-Speed 200MB IDE Hard Drive**
  This 3.5" half-height drive with a 1500K transfer rate features on-drive disk caching for even greater performance and reliability.
- **512K Super VGA**
  The Swan Super VGA card graphically outclasses competitive products. This card possesses 8514A capabilities, providing a resolution of 1024 x 768.
- **1024 x 768 VGA Color Monitor**
  This 14" monitor has a .28 dot pitch and supports multi-frequency or fixed frequency analog color.
- **4MB RAM Standard**
- **64K RAM Cache**
- **1.2MB 5.25" & 1.44MB 3.5" Floppy Drives**
- **1 Parallel, 2 Serial Ports**
- **MS-DOS 4.01**
- **101 Key Keyboard**

486/25	VIDEO OPTIONS Include Monitor & Video Adapter			
Drive Options	Mono	14" Flat Mono	VGA Mono	1024 VGA
w/84MB (19ms) IDE	$4745	$4795	$4945	$5145
w/200MB (16ms) IDE	$5245	$5295	$5445	$5645
w/330MB (16.5ms) SCSI	$6545	$6595	$6745	$6945
w/660MB (16.5ms) SCSI	$7245	$7295	$7445	$7645

Swan Cache Systems: First For Features



Performance

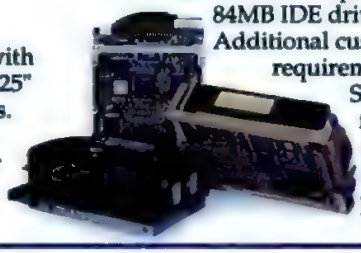
These systems are top-performers in their class, thanks to advanced algorithms and top-quality components. Each system comes with 4MB of RAM standard and both 5.25" and 3.5" high density floppy drives. The color VGA option includes Swan's super-fast video card with 512K on board plus our 1024 monitor to deliver crisp 1024 x 768 images. Many other video options are available—call for details.

Expandability

Memory is upgradable to a full 16MB. These systems feature eight expansion slots. For even more expandability, choose the tower option, featuring five drive bays, a tough 230W power supply and a second cooling fan.

Options

Standard hard drive options range from a high performance 84MB IDE drive through a 660MB SCSI subsystem. Additional custom configurations to satisfy special requirements are available.



Swan offers: modems, tape backups, fax boards, scanners...and more. We'll install internal devices for you prior to our extensive testing and burnin process—your assurance of reliability.

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Complete 200MB VGA system

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- 32K of SRAM cache
- 4MB of 32-bit RAM
- 200MB 16ms IDE drive
- High resolution color VGA (1024 x 768)
- Dual high-density floppy drives
- 1 parallel, 2 serial ports
- DOS 4.01 installed
- Utilities software
- Free on-site service

Many other configurations available—call for details

Swan 386/25C

Complete 84MB VGA system

$3095

- 32K of SRAM cache
- 4MB of 32-bit RAM
- 84MB 19ms IDE drive
- High resolution color VGA (1024 x 768)
- Dual high-density floppy drives
- 1 parallel, 2 serial ports
- DOS 4.01 installed
- Utilities software
- Free on-site service

Many other configurations available.

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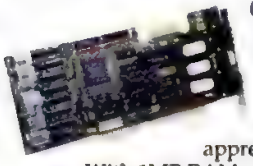
***Also available*...Swan Multiscan Monitor**
Enjoy Super VGA display and guaranteed compatibility with other video modes. This multiscanning monitor provides a resolution of up to 800 x 600. The 14" anti-glare screen, .31 dot pitch, auto screen sizing and centering, and tilt/swivel base combine to reduce eye strain. Accepts both analog and digital input. **$399**

The Fastest VGA Card We've Ever Tested!



Obtain incredible graphics and speed with Swan's new Super VGA card.

Swan Super VGA Card (512K) **$189**

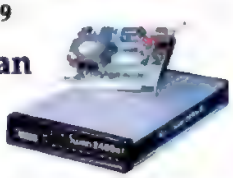
Treat your eye to superior clarity and the fantastic colors of Super VGA. The true professional will appreciate the 1024 x 768 resolution of this 16-bit card. With 1MB RAM, you can display up to 256 colors at a resolution of 1024 x 768 on an 8514A monitor. This card includes high-resolution drivers for many popular applications. Supports all VGA modes.

Super VGA (256K) .....$159 Super VGA (1MB) $229

***Also available*...Swan 8-bit VGA Card $119**

Broaden Your Horizons With Swan

The fastest modem available.



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- **7 expansion slots and 4 device bays**
- **Fast access IDE hard drives: 20MB to 170MB**
- **512K RAM expandable to 8MB**
- **200 Watt power supply**

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Complete system with 20MB drive, TTL mono

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- **640K RAM standard**
- **Full range of video options available**
- **On-site service available–$59 for 1 year**
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If reliability and value are important to you, look no further. This machine, designed with dependability in mind, uses 100% surface mount technology and full VLSI ASIC implementation. With all of its features and the security of on-site service for just $1395, the Swan 386SX offers a value that can't be beat.

386SX	VIDEO OPTIONS Include Monitor & Video Adapter			
Drive Options	Mono	14" Flat Mono	VGA Mono	1024 VGA
w/42MB (19ms) IDE	$1395	$1445	$1595	$1795
w/84MB (19ms) IDE	$1645	$1695	$1845	$2045
w/200MB (16ms) IDE	$2145	$2195	$2345	$2545

Look At All You Get For These Incredible Prices:

- FREE one year on-site service TRW
- Fast 42MB hard drive with 19ms access time—features disk caching for even faster access!
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- MS-DOS®, OS/2®, UNIX® compatible
- 1MB of 80ns RAM
- Your choice: 1.2MB 5.25" or 1.44MB 3.5" floppy drive
- 1 parallel, 2 serial ports
- 7 expansion slots
- Enhanced 101-key keyboard
- Complete, highly-rated documentation

S-X5AC

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A high performance 386 at a stunning price.

Too good to be true? New manufacturing technology and volume buying of high quality components make it possible. The systemboard is manufactured using the latest in Surface Mount Technology automation and a high level of chip integration. This keeps costs low and reliability exceptionally high.

386/25	VIDEO OPTIONS Include Monitor & Video Adapter			
Drive Options	Mono	14" Flat Mono	VGA Mono	1024 VGA
w/42MB (19ms) IDE	$1795	$1845	$1995	$2195
w/84MB (19ms) IDE	$2045	$2095	$2245	$2445
w/200MB (16ms) IDE	$2545	$2595	$2745	$2945

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"Never before has such an exhaustive study of service, support and reliability in the PC industry been undertaken."*

"Swan took top honors not only for tech support and repair service satisfaction but also for customer loyalty."*

"These people are great when it comes to making things work for the customer."*

Daniel Morgan—New York, NY

"We've put a lot of emphasis on a quality tech support program."*

Jack Conrad—CEO, Swan Technologies

PC MAGAZINE

*excerpt from Service and Reliability Survey results as reported in September 25 issue of PC Magazine CIRCLE 268 ON READER SERVICE CARD

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Swan TECHNOLOGIES

FAX LINE MANAGERS: SUMMARY OF FEATURES

Products listed in ascending price order

All 15 of the fax line managers we reviewed have some features in common, including automatic ring detection, extension detection, fax detection, and call blocking. In addition, they can all cope with older fax machines that do not transmit a CNG tone until greeted by a tone from the called device. Other features are listed in the table.

Uses standard terms means that the product's ports of access are labeled with plain English words like *phone, fax,* and *modem,* rather than nonstandard abbreviations.

PBX installation by user A yes answer means that the product can be installed in a PBX (or Key) system without professional help.

An **AUX port** is needed to access another device, such as a remote point-of-sale (POS) terminal or credit authorization terminal (CAT).

Surge suppression indicates some means of protection against lightning strikes or power fluctuations.

Polling means that the product can remotely access a device that permits external access, such as a PC.

Ring delay indicates that after a user-specified number of rings the line manager will relay the call to another device like a fax machine or telephone.

A **TAD ring counter** allows users to program the line manager to relay the call to a telephone answering service (TAD) after a predetermined number of rings, even if the answering machine does not allow the user to set the ring count.

Open line notification is the line manager's audible signal to you (or anyone else who picks up an extension phone) that it is working and on-line.

Reverse modem detection refers to the fax line manager's ability to detect that a calling party is a modem. Unlike a fax

	Electronic Technologies **RemoteControl** $35.00	Crest Industries Inc. **AutoFax Switch** $125.00	High-Tech Resources Inc. **The Switch, Model A-5** $149.00	Technology Concepts Fax Line **Manager, Model 202** $169.00	ACCO International Inc. **ACCO 1-Line** $179.00	Call Management Products Inc. **FAX LineShare** $199.00
GENERAL						
Includes installation manual	■	■	■	■	■	■
Uses standard terms	■	■	■	■	■	■
PBX installation by user	■	❑	❑	❑	❑	❑
Configuration options:						
Fax/phone	■	■	■	■	■	■
Fax/modem	■	■	■	■	■	■
Fax/modem/phone	■	❑	■	■	■	❑
Fax/modem/phone/TAD	■	■	■	■	■	❑
AUX port	■	❑	■	❑	❑	❑
Device size:						
Full	■	■	❑	■	❑	❑
Compact	❑	❑	■	❑	■	■
Surge suppression	❑	❑	❑	❑	❑	❑
LINE MANAGEMENT FUNCTIONS						
Polling	■	❑	■	■	■	❑
Ring delay	■	❑	❑	■	❑	■
TAD ring counter	■	❑	■	■	■	❑
Fax/AUX ring counter	■	❑	❑	■	❑	❑
Non-CNG-transmitting faxes	■	■	■	■	■	■
Open line notification	■	■	❑	■	■	■
Reverse modem detection	■	❑	■	■	■	❑
TAD-to-fax transfer	■	■	❑	■	■	❑
Phantom ringback	■	■	■	■	■	❑
Fax screening	■	❑	❑	■	❑	❑
Modem access codes	■	❑	❑	❑	❑	❑
Modem initialization string	■	❑	■	■	❑	❑
Uses ROM to detect modem calls	❑	❑	❑	■	❑	❑
911 override	❑	❑	❑	❑	❑	❑
SUPPORT						
Product warranty	1 year	2 years	1 year	2 years	1 year	1 year
Telephone support (hours per day)	12	24	24	24	24	24
Toll-free telephone number	■	■	■	■	■	■
Toll-free fax number	❑	❑	■	■	❑	❑

★–Editor's Choice ■–Yes ❑–No

machine, a calling modem listens for a tone from the receiving modem before sending its own tone.

TAD-to-fax transfer means that the fax line manager will instruct the caller to enter a code, and then will relay the call to the fax machine. This is intended for callers with older fax machines that do not generate a CNG tone.

Phantom ringback After answering the phone, the switch may produce a ring that the caller hears while the call is being analyzed and routed to the appropriate device (such as a fax machine or modem).

Fax screening is a means of automatically refusing to accept faxes if the caller does not enter a predefined access code in response to a prompt.

A **modem access code** is a security feature intended to keep out unauthorized modem callers. When two modems are connected, the caller must enter a prespecified code, or the fax line manager will break the connection.

Modem initialization string is an extension to the calling modem's setup string, which then provides a tone enabling some fax line managers to distiguish between incoming modem and voice calls.

Uses ROM to detect modem calls Instead of listening for an audible code within the calling modem's initialization string, the switch may identify modem calls by sending out a tone and listening for a response.

911 override With some switches, dialing 911 will automatically free up the line in an emergency.

Lynx Automation Inc. **ExtraLine** $199 00	MaxTrek Inc. **SmartMax, Model 6000** $199.00	Command Communications Inc. **ASAP TF 555** $199.95	Rainier Technologies Corp. **Automated Voice/Data Switch, Model TB-150** $199.95	VSI Telecommunications Inc. **FaxSwitch II, Model 1002** $225.00	Electronic Modules Inc. **SmarterFax Switch** $249.00	Viking Electronics Inc. **PathFinder, Model PDF-1** $249.00	Advanced Electronic Applications Inc. **FAXSaver Voice/Fax Switch** $299.00	Multi-Link Inc. **Versa-Link, Model ATX-300** $395.00
■	■	■	■	■	■	❑	■	■
■	■	■	■	❑	■	■	■	■
❑	❑	❑	❑	■	❑	■	❑	❑
■ (fax/phone version)	■	■	■	■	■	■	■	■
■ (fax/modem version)	■	■	■	■	■	■	❑	■
❑	■	■	■	■	■	■	❑	■
❑	■	■	■	■	■	■	❑	■
❑	■	■	■	■	■	■	❑	■
❑	❑	■	■	❑	■	❑	■	■
■	■	❑	❑	■	❑	■	❑	❑
❑	❑	❑	❑	❑	❑	❑	❑	■
■	■	■	■	■	■	■	❑	■
■	■	■	■	■	■	■	❑	■
❑	❑	■	❑	■	■	■	❑	■
❑	■	■	❑	■	■	■	❑	■
■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■
■ (fax/modem version)	■	■	❑	■	■	■	❑	❑
■	■	■	■	■	■	■	■	■
❑	■	■	❑	❑	■	■	❑	■
■	❑	■	❑	❑	■	■	❑	❑
❑	❑	■	❑	❑	■	■	❑	■
❑	❑	■	■	❑	■	■	❑	■
❑	❑	❑	❑	❑	❑	❑	❑	❑
❑	❑	■	■	❑	❑	❑	❑	❑
1 year	2 years	2 years	1 year	2 years	1 year	1 year	1 year	1 year
24	24	12	8	24	12	12	8	12
❑	■	■	■	■	■	❑	❑	■
❑	❑	■	❑	■	❑	❑	❑	❑

The difference betw fax board and

Intel's new SatisFAXtion™ fax board costs less than $500. And while that prices it well under some fax boards, there are still cheaper alternatives.

So we thought it only fair to explain what you'll be getting with ours.

Or, missing with theirs.

1. The SatisFAXtion board is the only one that lets you fax a document exactly as you'd send it to your printer. One step, five seconds, and you're back to work. There's no easier way to fax—period.

2. With the SatisFAXtion board you get true WYPIWYF™—what you print is what you fax. Text is never distorted, fonts never switched, formats never lost. You can even connect a scanner and fax photo-quality images with up to 256 levels of grey.

3. Once a fax starts coming in or going out, most boards bring the work your computer's doing to a screeching halt. Even a simple fax could tie up your PC for several minutes. But the SatisFAXtion board has its own dedicated 16 MHz microprocessor. All your faxing happens entirely in the background, so you and your PC don't skip a beat.

4. The SatisFAXtion board automatically configures and installs itself in your PC. Cheaper boards are a nuisance, with DIP switches, jumpers, and long, convoluted procedures to mess with.

5. If you ever have a question about your SatisFAXtion board, you can get answers directly from Intel experts—either by phone, fax, or modem.

6. Offices don't communicate by fax alone, so the SatisFAXtion board gives you a built-in MNP 5 modem that works twice as fast as ordinary modems. This alone is worth $300!

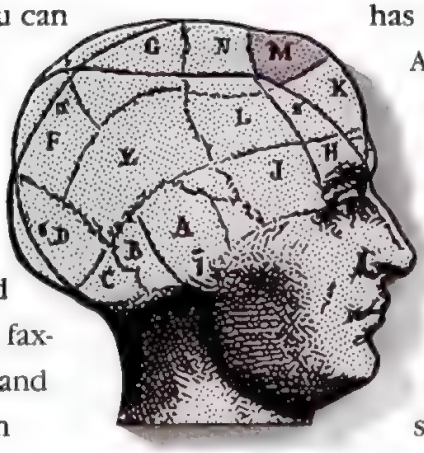
7. While cheaper boards hog over 100K of conventional memory just to send a fax—even if your PC has expanded RAM—the SatisFAXtion board needs as little as 9K.

Ordinary fax boards make you look this bad.

The *SatisFAXtion* board makes you look this good.

een an inexpensive a cheap one:

Which means you can easily fax from within even the most powerful, memory-hungry applications.



8. If you need help while you're faxing, just press F1 and follow the built-in directions.

9. Our board is covered by a 5-year warranty—more than twice as long as cheaper fax boards. (We'll leave it to you to figure out what that implies.)

10. No other fax board is designed to run crash-free under Windows 3.0. Just load *FAXit® For Windows* software—which, by the way, is free to all SatisFAXtion buyers—onto your PC, and you can fax directly from any Windows 3.0 application that can print.

11. What more could we add to the fax board that has everything? Actually, quite a bit: For a limited time, when you buy the SatisFAXtion board you'll also get *PC Tools Deluxe*™ software free, as well as $100 worth of discounts on other PC hardware and software products.

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Suggested retail price of Intel's new SatisFAXtion board.

We think you'll find that the difference between a cheap fax board and an inexpensive one can really be summed up in one word: SatisFAXtion.

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FACT FILE

ExtraLine
Lynx Automation Inc., 2100 196th St. SW, #144, Lynnwood, WA 98036; (206) 744-1582.
List Price: Fax/phone or fax/modem version, $199. RingDirector/2, $89; RingDirector/4, $149; DataDirector, $199.
In Short: ExtraLine packs a lot of features in its compact case and does a decent job of handling junk fax calls as well. While Lynx has put little emphasis on modem handling, even in its fax/modem version, the availability of the two-port RingDirecto—plus the inclusion of built-in surge suppression and filtering—makes this a good choice.

CIRCLE 546 ON READER SERVICE CARD

backup or nonvolatile EEPROM. But its two-port ring director makes up for this. The ring director uses the latest technology to add two distinctive-ringing lines, without the expense of dedicated lines. You have to activate DIP switch 5 to take advantage of these two lines. The normal cost of the distinctive-ring feature is about $5 per month for each additional line, potentially saving you the price of the product.

Lynx offers two additional products using distinctive-ring technology. The RingDirector/2 gives you access to two additional phone lines for only $89; the RingDirector/4 allows you four additional lines and sells for $149.

The company also produces another switch that is designed for BBS users, called the DataDirector ($199). The DataDirector allows system operators the ability to add two distinctive-ring lines to the existing dedicated modem line.

The availability of the two-port RingDirector and the inclusion of many added features sets the ExtraLine apart from other switches that we tested, but its warranty period is only one year. Lynx provides full technical support from 7:30 to 5:30 P.S.T. The telephone number is not toll-free, but the company does supply 24-hour answering of calls.

MAXTREK INC.
SmartMax

You may find a good product in the SmartMax, Model 6000, despite a few limitations. The fax/phone setup does not screen fax calls, nor does it remotely direct calls to the modem or fax. The tasks it performs, however, it does well. And the price—$199, with a street price of about $149—helps offset its lack of options. The SmartMax is a full-size switch, measuring 2 by 6.9 by 4.9 inches and weighing 1.6 pounds.

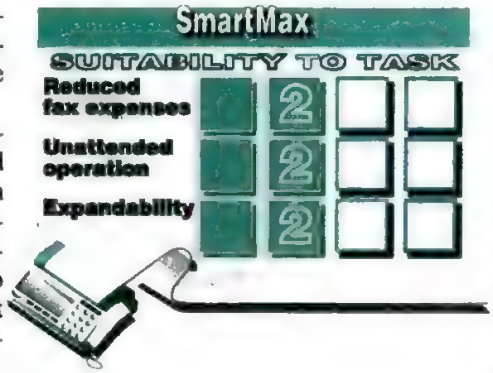
The product automatically handles fax and voice messages without requiring sender action, but it works only if the fax uses CNG tones. You must manually route calls from older fax machines that don't use CNG tones by pressing a number on a Touch-tone phone.

Installation uses a simple plug-in approach, requiring no special tools on a single line. If you install the SmartMax on a multiline system or you have extension phones, you will need additional parts (splitters, cabling, and other low-cost items) as listed in the manual. The manual is clear and uses simple diagrams to explain different possible configurations for each system.

The SmartMax features automatic ring detection and can lock extensions out when fax transmissions occur. The unit provides phantom ringback when analyzing incoming calls. You can also transfer a call to your answering machine, and the caller can listen to instructions on how to send a fax after the message.

HELP REQUIRED ON PBX/KEY

The SmartMax works on both single- and dual-line systems as well as PBX or Key systems. The installation on PBX and Key



FACT FILE

SmartMax
MaxTrek Inc., 23210 Bernhardt St., Hayward, CA 94545; (800) 445-4451.
List Price: Model 6000, $199.
In Short: SmartMax provides ample features for the home user who does not want such extras as fax screening and remote device polling. MaxTrek could gain a larger following by enhancing its switch.

CIRCLE 547 ON READER SERVICE CARD

systems requires professional help, so add that into the cost. Furthermore, the switch lacks several features we found on other models.

The main area of concern is that it does not screen junk fax calls. And you can't program a ring delay, divert calls to a remote device for polling, or handle modem calls. For the latter you'll need the Model 6500 ($249), which handles fax, phone, and modem. MaxTrek did not provide one of these for our review.

MaxTrek warrants its fax-line-sharing products for two years. The company also provides technical support via a toll-free number, 8:00 to 5:00 P.S.T., with 24-hour monitoring via an answering machine.

MULTI-LINK INC.
Versa-Link

Multi-Link's Versa-Link ATX-300, at first glance, may seem too high-priced at $395, especially if you consider that the product does not offer fax screening, and it comes with a mere one-year warranty while some competing products offer two years. If you look closer, however, you'll see that the Versa-Link offers you extra features such as surge suppression and additional lightning-strike protection. The product also has a nonvolatile EEPROM chip to store your default settings, eliminating the need to reprogram them in the

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protection, ensuring signal privacy between devices. Rainier also includes open-line notification, extension detection, and TAD-to-fax transfer. The product also allows access to remote devices such as POS terminals, CATs, and tank sensing units.

TWO MODES OF OPERATION

The Automated Voice/Data Switch has two modes of operation. "Auto" mode answers on the first ring, screening for the CNG tone. This mode defaults to the phone or answering machine if it doesn't detect the CNG. "Man" mode sends all calls to the telephone, letting you manually direct calls to the fax device.

If you lose power, the switch will default to the phone port. If you have call waiting, don't worry: The Automated Voice/Data Switch will operate, but you might lose a fax or modem call. Modems connected to the fax port require the caller to include a special dialing string in the calling sequence. The dialing string calls for an 8-second pause after connecting to the other modem, followed by a series of "*4"s.

Rainier's 911 feature provides an override during an emergency.

Rainier includes three additional features. The first, Fax Announcer, rings the telephone with a distinctive ring to let you know that a fax has come in. Fax Director sends calls to the fax machine or board; this feature becomes useful during evening hours and weekends. The 911 feature provides an override capability during an emergency.

Although Rainier has less than three years' experience in the fax-line-sharing arena, it provides excellent features and a solid company philosophy rolled into fine products. But the company warrants its line-sharing devices for only one year against defects in parts and labor. Technical support is available on a toll-free number, from 8:00 to 5:00 P.S.T.; there is no after-hours support.

A GLOSSARY OF LINE MANAGEMENT TERMS

GENERAL TERMS

call blocking A feature whereby a switch prevents extension phones from accessing a line currently in use by another device, ensuring data integrity during reception of both fax and voice communications. This is also known as *line exclusion*.

call waiting A feature provided by many phone companies, allowing the user to manage two calls on a single line at the same time. Most switches don't handle this feature very well.

CO (central office) "The phone company," or the building where the telephone line is electronically managed.

extension Any additional phone attached to a single line (of a small business), or station in a Key or PBX system.

ground start The method whereby some lines and devices establish a dial tone by completing a circuit between one of the wires of a line and an earth ground. PBX equipment is the primary application of ground circuits. See *loop start*.

junk faxes Unsolicited fax transmissions received by an office, often containing information unrelated to the recipient's type of business.

loop start The method whereby certain lines and devices establish a dial tone by completing a circuit between two wires on a line. Fax machines, modems, and switches have this feature.

off-hook Actively in use.

on-hook Idle. The term comes from the image of a telephone handset resting on its hook switch when the phone line is not in use.

OPX (off-premises extension) A line much like a party line, serving more than one subscriber location. This is often used by answering services and lines that serve more than one building. Most fax machines and fax line managers do not operate in this kind of environment.

party line A line serving more than one subscriber or user at one time. Fax line managers do not operate in this kind of environment.

polarity A term used to describe the charge of two electrical points, one positive and the other negative. In an RJ-11 female jack, green leads are positive, red ones negative.

RJ-11 wiring standard A standard wiring arrangement using a six-prong modular connector to attach one telephone. Two wires of the telephone line are attached to the two center contacts of an RJ-11 modular jack, which are often color-coded red and green.

RJ-14 wiring standard A wiring arrangement using a six-prong modular connector wired to two separate phone lines. This is used most often with dual-line telephones. Line 1 attaches to the center two contacts (as with RJ-11); line 2 attaches to the second and fifth contacts in the row, normally colored yellow and black.

rollover A service provided by the local phone company, tying several lines together. Callers dial a single number, and if the line is busy the phone company "rolls the call over" to another line in the group. This group is sometimes called a *hunt group* or *rotary*.

rotary A name for the rollover group, not to be confused with *rotary dialing*—meaning pulse dialing.

station A telephone set that is attached to a multiline Key system or to a PBX. A number of today's fax line managers work with both types of multiline systems.

trunk line The line connecting a telephone to the central office.

Another model, the TB-140 (also priced at $199.95), features a fax/modem configuration for BBS system operators. Rainier also markets the TB-201 ($249.95), which handles two devices and allows the user to program a greeting message explaining how to operate the switching system. Rainier's three-device Type I switch, the TB-301, sells for $279.95 and offers the same answering options.

TECHNOLOGY CONCEPTS INC.
Fax Line Manager

Technology Concepts has bundled a lot of well-planned features into its full-size switch without losing ground in this price-sensitive market. The Fax Line Manager Model 202 detects and routes voice calls, fax messages, and computer modem connections hooked up to a single telephone line.

Technology Concepts designed the $169 Model 202 for use with phone/fax or fax/modem setups. We tested an upgraded unit, the Model 203, which offers phone/fax/modem capabilities at $229. Both units work with answering machines, too, and have full-sized cases: 1.5 by 7 by 8 inches, with a weight of 1.5 pounds.

The installation process is simple. The Fax Line Manager labels the ports on the rear of the unit, and the manual provides concise instructions on all hookups. During the modem installation phase, however, we came across an area that concerned us: The listed modem initialization string did not work as intended.

After playing with the modem sequence

EQUIPMENT

AUX (auxiliary) port A secondary access port found on many telephone answering machines and fax line managers; it allows the user to add more lines or services.

call processor Any device managing telephone traffic and routing incoming calls to the appropriate device.

CAT (credit authorization terminal) A device that scans a credit card before authorizing purchases, used by business representatives when working at a remote location.

fax (facsimile) machine A device that attaches to your telephone line to send or receive a document electronically. It is sometimes called a *telefax* or *telecopier*.

Key telephone system A multi-line telephone system with several extensions attached to a Key system unit (KSU). Each telephone uses a series of buttons to select particular outside lines.

KSU (Key system unit) The controller managing a Key telephone system. Normally mounted in the back room or telephone closet within an office, it serves incoming phone lines and all telephones connected directly to it.

modem A device that allows computers and other electronic equipment to communicate with each other, using ordinary telephone lines to share data.

modular connector A catch-all term for a variety of telephone plugs and jacks, handset connectors with four or six contact points, and similar equipment.

PBX (private branch exchange) A type of electronic multiline telephone system used primarily in very large corporations having many extensions and requiring users to dial "9" to get an outside line. Such an exchange often uses a standard single-line telephone for each extension.

PC fax board A circuit board that installs inside a PC and operates much like a fax machine, attaching to your telephone line and transmitting or receiving images to and from other fax boards or fax machines. A fax board can often operate like a modem, used in conjunction with a printer and a document scanner. Helpful features include scheduling faxes for after-hours transmission and sending faxes to several parties simultaneously.

POS (point-of-sale) terminal Either a cash register or a computer-based system that allows the entry (often the remote entry) of sales in a business. It generates reports and receipts to account for inventory and cash received.

remote tank sensing unit A meter that measures the contents of an underground tank of gasoline or other fluid and allows the data to be remotely accessed.

TONES

TAD (telephone answering device) Any device that can connec to your telephone, using a standard RJ-11 connector, to monitor and record incoming calls.

access codes or tones A series of tones, defined by the user, allowing or restricting access to some device attached to a switch or phone line. Codes are entered from the user's or the caller's keypad.

auto-fax or CallING (CNG) tone The tone produced by relatively new fax machines when dialing a receiving fax device. Modulating at 1,100 Hz and lasting 0.5 second, it repeats every 3.5 seconds for approximately 45 seconds after the host dials the fax number.

carrier and data tone The loud screech produced when two fax machines, boards, or modems transfer files.

DTMF (dual-tone multifrequency) The tone heard most often when you are using a Touch-tone or keypad phone, although not all push-button phones can produce DTMF tones.

ringback The audible ring, produced by telephone processing equipment, signaling the caller that the other party is being rung. This sound is duplicated by many fax line managers while a call is being analyzed and routed to the appropriate device. ■

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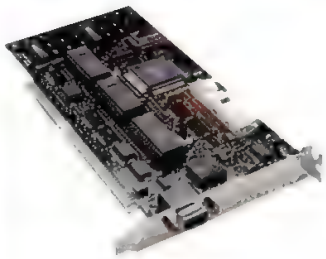

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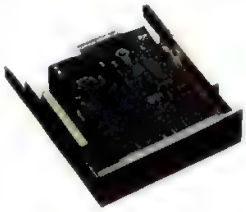

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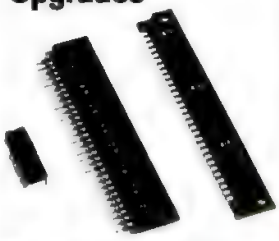

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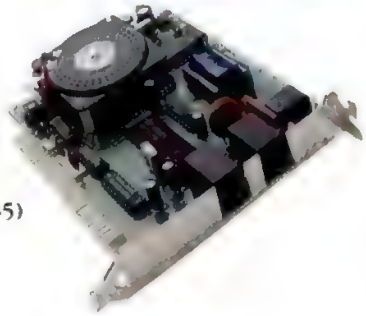

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CIRCLE 280 ON READER SERVICE CARD

PCM 9-21A

Fax Line Manager
Technology Concepts Inc., 1159 Triton Dr., Foster City, CA 94404; (800) 852-6881.
List Price: Model 203, $229.
In Short: The Fax Line Manager's easy installation, along with the two-year limited warranty, makes this an economical and effective solution for simultaneous access to voice, fax, and modem.

CIRCLE 550 ON READER SERVICE CARD

and calling TCI, we got the correct combination. The string listed in the manual, "ATDT5551234,,,,,44444", did not work in the "S" register; we used "ATDT5551234,,,,,4,4,4,", after which everything went smoothly. The Model 202's ROM chip with Data Detect avoids this problem and eliminates the need for the additional dialing configurations. The Model 203, because it handles voice calls as well as faxes and modem transmissions, does not.

INTERCEPTS INCOMING CALLS

The Fax Line Manager intercepts incoming calls and checks for a fax CNG tone, then for an access code entered by the calling or answering party. The access code uses a series of Touch-tone codes to route the call to either the fax (default "33") or modem (default "44"). If The Fax Line Manager doesn't detect either code, it interprets the call as a voice/answering machine, allowing five rings of the phone before sending the call to the fax machine or modem. The Fax Line Manager does this to ensure that the older fax machines (and any others that do not generate a CNG tone) will get their messages through.

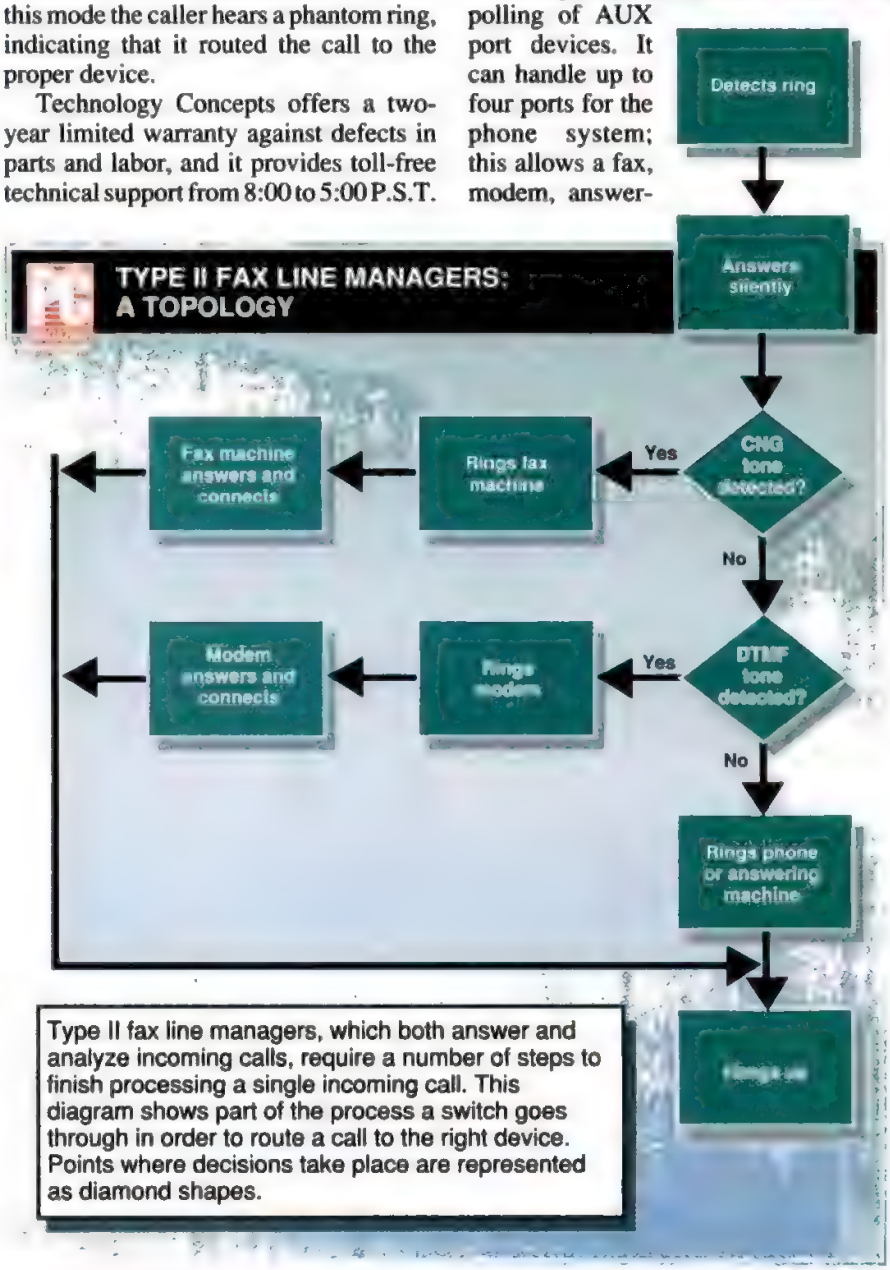
The Fax Line Manager lets you use the telephone keypad to program custom ring counts; thus you can configure the number of times your phone will ring before the call rolls over to the fax machine or modem. The Fax Line Manager also features barge-in protection for the phones, fax, and modem that connect directly to the switch. It provides an optional method for preventing extension phones from intruding on either fax or modem calls.

The Fax Line Manager comes from the factory set up in the SmartAnswer Mode, which allows you to answer an incoming call anytime before the fifth ring. It also has an AutoAnswer Mode, designed either for PBX/Key systems or for times when all the phones are wired to the Fax Line Manager switch; in this mode, it answers the call and sends it immediately to the fax if a CNG tone sounds. If you use this mode the caller hears a phantom ring, indicating that it routed the call to the proper device.

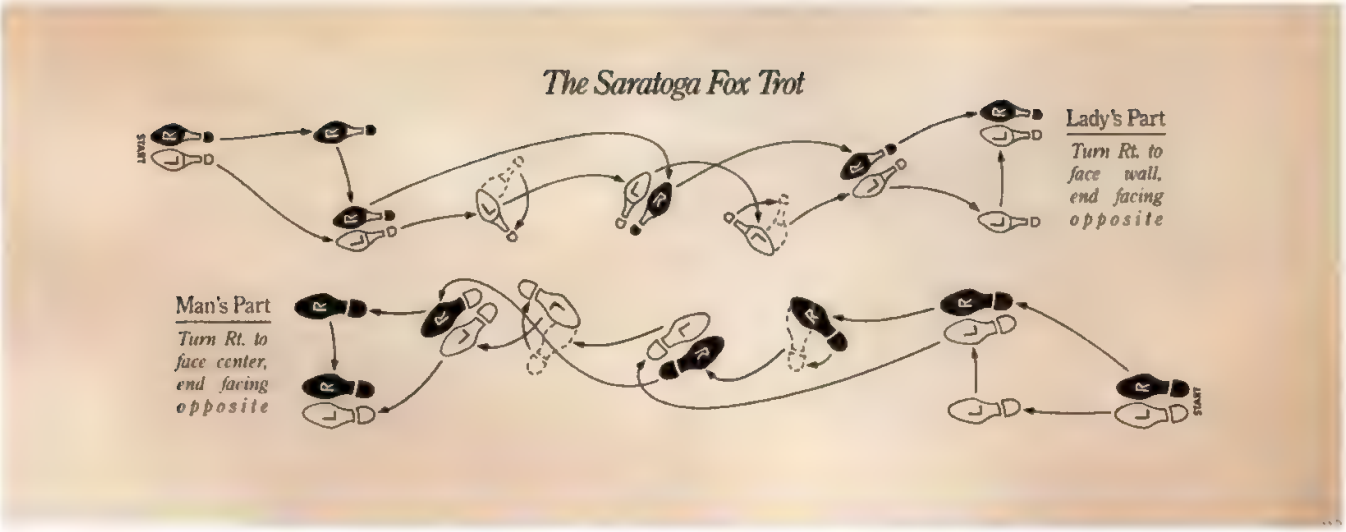
Technology Concepts offers a two-year limited warranty against defects in parts and labor, and it provides toll-free technical support from 8:00 to 5:00 P.S.T. After hours, an answering machine accepts calls.

VIKING ELECTRONICS INC.
PathFinder

Viking Electronics Inc. may have a great product, but the compact ugly duckling it has hatched doesn't fit in with the decor of most front offices. But the PathFinder's ugliness is only skin deep. This $249 product's versatile switching capabilities and admirable features make you look deeper. Once you're past its poor documentation, you'll appreciate that the unit handles fax screening, restricted modem access, and polling of AUX port devices. It can handle up to four ports for the phone system; this allows a fax, modem, answer-



Type II fax line managers, which both answer and analyze incoming calls, require a number of steps to finish processing a single incoming call. This diagram shows part of the process a switch goes through in order to route a call to the right device. Points where decisions take place are represented as diamond shapes.



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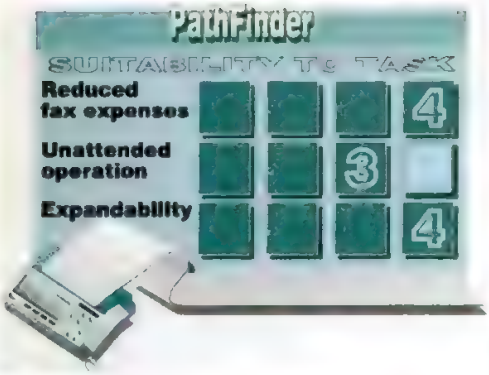
CIRCLE 278 ON READER SERVICE CARD



ing machine, and telephone to access the same line.

The PathFinder, Model PDF-1, provides ideal remote polling in point-of-sale terminals, polling data and other information from cash registers and modems. The switch automatically determines the appropriate device to which each incoming call should be routed, and it does this while remaining transparent to the caller.

The PathFinder measures 1 by 3.5 by 3 inches and weighs 3 pounds. It requires 24-hour unswitched 120V AC power, and it does not offer surge protection. (Viking recommends purchasing a surge protector before you install the unit.)

LABELING AND DOCUMENTATION

The PathFinder is well labeled, although the company earns demerits for its documentation on installation. Fortunately, the basic installation is easy, since the switch uses RJ-11 connectors.

Viking equips the PathFinder with four ports for access. It uses a phantom ringback, so the caller remains unaware of the device analyzing and routing the incoming call. It also provides ring delay and a TAD ring counter, which enables you to specify the number of rings you want before the call is automatically routed to the answering machine. The fax ring counter lets you prescribe the number of rings before the call rolls over to the fax board or machine.

The PathFinder includes open-line notification, automatic fax detection, and automatic TAD-to-fax transfers. In addition, it makes arrangements for older fax machines that don't send a CNG tone. The inbound caller merely enters a single-digit access code.

Viking Electronics' PathFinder uses reverse modem detection, letting callers access your modem without tricky initialization strings.

The PathFinder also uses reverse modem detection, allowing callers to access your modem without tricky modem initialization strings. Another plus is that the product screens faxes by requiring the caller to include an access code in the dialing string for the fax machine. It uses the same type of protection on the modem side of the switch; in this respect the PathFinder stands out from most other switches.

You can install the PathFinder on both single-line phone systems and PBX/Key systems. Here's yet another plus: Viking states that installation on PBX and Key systems doesn't require that you get professional help. And in the event that power should fail, all calls default to the voice phone. The PathFinder offers extension detection and call blocking, ensuring that all fax and modem calls remain uninterrupted.

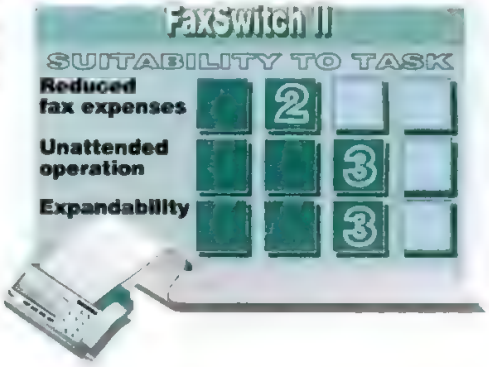
One drawback is that Viking issues only a one-year warranty. It does offer technical support from 8:00 to 5:00 C.S.T., but it prefers that you seek support through the VAR and distributor network. The company will accept user calls, but it does not provide a toll-free number or after-hours support.

PathFinder
Viking Electronics Inc., 1531 Industrial St., Hudson, WI 54016; (715) 386-8861.
List Price: Model PDF-1, $249.
In Short: The PathFinder's many beneficial features help make you forget that Viking dropped the ball when it came to aesthetics and documentation. The product screens fax calls and limits access to the modem, using a user-definable access code and remote device polling.

CIRCLE 601 ON READER SERVICE CARD

VSI TELECOMMUNICATIONS INC.
FaxSwitch II

Even though it's the new kid on the block, VSI Telecommunications has designed flexibility into its fax/modem/voice switches. The FaxSwitch II, Model 1002, sells for $225 and is compact in size. But don't let its size fool you. Despite its



size—1.3 by 3.3 by 3.8 inches and 0.5 pounds (plus the transformer)—the FaxSwitch II packs a lot of goodies into a small-footprint form. VSI is partway to success in the fax-line-sharing market. If it wants to stay on top of the rapidly changing technology, it can become a front-runner by making additional enhancements.

The FaxSwitch II, designed for fax, modem, and answering machines, is transparent to the caller. Designed primarily for ease of use, it is compatible with all Hayes modems, or any others that allow the user to adjust the carrier detect time and the number of rings to the modem.

Although its design does not have a separate AUX port, you can make the switch function as if it had one by using a line splitter. This lets you poll remote devices.

SIMPLE INSTALLATION

Installation is simple, although the instruction manual will leave you cold. The switch is labeled, but not as clearly as others we reviewed: The label on the fax port is fine, but the incoming line and the line to the telephone ports use the labels

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FACT FILE

FaxSwitch II
VSI Telecommunications Inc., 9329 Douglas Dr., Riverside, CA 92503-5618; 800/999-8232.
List Price: Model 1002, $225.
In Short: FaxSwitch II is a flexible product, but it needs more features to be truly competitive. By adding enhancements like fax screening and modem line security, along with phantom ringback, VSI could give its customers more value for their investment.

CIRCLE 602 ON READER SERVICE CARD

"c.o." and "ph.sys.," respectively, causing confusion and increasing the installation time. The manual also lacks diagrams, which would speed up the process.

The FaxSwitch doesn't require the user or caller to program security tones or access codes when accessing the modem or fax device. This could cause problems from the standpoint of business security and operating expenses.

FaxSwitch II has call blocking, but it can neither screen junk calls nor restrict modem access.

Although the product has call blocking, it lacks the ability to screen junk fax calls or restrict access to the modem port. The system works with single-line and PBX/Key systems, but the switch must be installed in front of the PBX switching system, not along the line preceding it.

The FaxSwitch uses programmable ring delay, with a limited TAD ring counter that works well as long as the total count between the phone and the TAD does not exceed five rings. A fax call could exceed the 35-second CNG tone time limit, because this switch does not use a phantom ring signal; by introducing one, it could increase its flexibility to match some of the others we reviewed. The FaxSwitch II does offer extension detection and automatic TAD-to-fax transfer.

VSI offers two additional products. The FMX (Fax-Modem) Switch connects a fax machine to a dedicated modem line for $159.95, adding fax flexibility for BBS operators. Businesses that would like to switch after-hours calls to a fax, modem, or auxiliary device could install the FaxSwitch (as opposed to FaxSwitch II) for the last line of a multiline system; this lists at $99.95.

VSI offers a two-year warranty on its products, and it has a toll-free voice and fax number—from 8:00 to 6:00 P.S.T.—and a 24-hour answering service. ■

R. Dennis Boatner *is a computer consultant working in northwest Florida.* **Frank J. Derfler, Jr.,** *is workgroup systems editor of* PC Magazine.

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Warranty	Parts: 2 years Labor: 1 year	Parts: 2 years Labor: 1 year

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HITACHI Accuvue 20-AF	30-65KHz	No	Yes	$3,880

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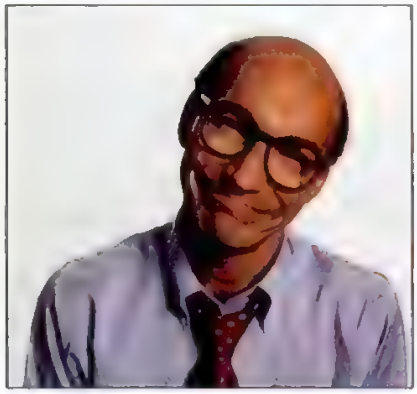
"Hi Mike, can you help me? I can't get on the network."



"I have some questions about this DOS stuff. Gotta minute?"

"Quick Mike, I desperately need a color monitor for a big presentation to our CEO!!"

"Hello Mike, sorry, I forgot my password. Again."

"How come they got it and we didn't get it, huh Mike? What's the deal?"

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LOW COST CAD

MODELING FOR THE MASSES

When we reviewed 12 high-end CAD packages in our March 27, 1990, issue, most of them had one thing in common: a fat price tag. Except for *DesignCAD 3-D*, those packages ranged in price from $995 (Schroff Development Corp.'s *SilverScreen*) all the way up to $8,000 (for MCS's *Anvil-5000*). Yet the three CAD packages we review in this issue—American Small Business Computers' *DesignCAD 3-D*, Foresight Resources' *Drafix 3-D Modeler*, and Generic Software's *Generic 3D Drafting*—all offer full 3-D modeling capabilities at a base price of less than $400.

You may be surprised to discover that on a command-by-command basis, these inexpensive packages come reasonably close to matching their expensive rivals. All were able to create the PC Labs test drawing, and all fared reasonably well against the same benchmarks and suitability-to-task criteria we used to evaluate high-end 3-D CAD packages.

Although $3,000-plus programs offer greater versatility, *DesignCAD 3-D, Drafix 3-D Modeler*, and *Generic 3D Drafting* may well pack all the power you need.

by Bruce Haase

In fairness, it's important to point out that two of the three packages we review here require you to use their 2-D CAD programs in conjunction with their 3-D offerings for a complete solution. *Generic 3D Drafting* and *Drafix 3-D Modeler* both lack dimensioning functions, so you'll have to export views of your model to their 2-D counterparts, *Generic CADD Level 3* and *Drafix CAD Ultra*, to perform these all-important functions. Even so, you can buy both the 2-D and 3-D versions for under $900, and together they give you all the capabilities—if not all the features—of 3-D programs costing thousands of dollars more.

A QUESTION OF SUPPORT

So why should you shell out $3,000 for a CAD package when you can get the same thing for $1,000? Well, there's more to 3-D CAD than just the ability to handle 3-D models. CAD professionals spend their workdays in front of their CAD stations, and for these users, productivity, not purchase price, is the important issue.

The vendors of the *Anvils*, *AutoCADs*, and *CADkeys* of the world are quick to point out that their broader command sets and their packages' greater depth of features ultimately lower the cost of the package through the time and effort they save. Moreover, they note, professional users also need full-fledged support networks that only vendors of more-expensive CAD packages can provide. It's no accident that high-end CAD vendors use dealers for training end users and provide support through hundreds of third-party organizations. The high prices of their products reflect the increased margins needed to pay for these services.

On the other hand, many small companies have simple needs, and for them, price may outweigh all other considerations. Moreover, even large organizations welcome the opportunity to put 3-D CAD on every engineer's desktop without busting their budgets, even when it's needed only occasionally.

Low-cost 3-D CAD packages are economical with equipment, running just fine on a basic XT without extra memory or a math coprocessor. And while their vendors admit that third-party program support for these packages may be limited, they contend that less support is needed because the packages are easier to learn and use. For a significant class of users, all of this adds up to the right product at the right price.

A QUESTION OF NEED

There are a few caveats to think about before rushing in. Though low-cost packages all provide at least one way to perform most basic CAD tasks, none of them gives you as many ways of performing them as the more-expensive systems do. And coexistence with professional CAD systems can be problematical. Only *DesignCAD 3-D* was able to import or export .DXF files without the aid of an optional file translation utility. *Drafix 3-D Modeler*, in fact, couldn't import anything at all and cannot export .DXF files.

And although *Drafix 3-D Modeler* proved fastest on our test suite, it was the only package for which we could not complete all three tests without its 2-D counterpart, *Drafix CAD Ultra*. You'll find mixed results for *DesignCAD 3-D* and *Generic 3D Drafting*, although *DesignCAD 3-D* was more than twice as fast as *Generic 3D Drafting* on our Hidden Line Removal test, the most demanding of all 3-D CAD operations.

In any case, there is no question that low-cost 3-D CAD is here to stay. Even the manufacturers of high-end products have decided to switch rather than fight. For example, Autodesk, maker of the venerable $3,500 *AutoCAD*, recently bought Generic Software, which produces *Generic 3D Drafting*, reviewed in this roundup. And Autodesk is not alone.

OUR CONTRIBUTORS

Bruce Haase is a college computer science instructor in Muskegon, Michigan. He is also a CAD/CAM manufacturing consultant and a senior member of the Society of Manufacturing Engineers.

Jeff Prosise, a mechanical engineer, is a contributing editor of *PC Magazine*.

LOW-COST 3-D CAD SOFTWARE: SUITABILITY TO TASK

All of these low-cost CAD packages have three-dimensional capabilities, but their functionality varies widely. Which program has the features you need the most? *PC Magazine*'s suitability-to-task ratings offer one way to help you decide. These are systematic, though subjective, ratings made by our reviewer. They reflect each package's ability in relationship to 3-D CAD packages in general, not just the packages reviewed here. For a more complete picture of what each product offers, compare these judgments with the information in the reviews and the features table.

THE TASKS

MECHANICAL MODELING This rating is based on the depth and ease of use of the product's 3-D modeling features, including 3-D entity creation and manipulation, surfacing and shading features, and multiple view creation.

MECHANICAL DRAFTING Drafting is the bread-and-butter work of most CAD installations; this rating judges the product's handling of lines and fills, dimensioning, and plotting. Also important are the ease with which users can pick views for further manipulation and the ability to import and export files (including .DXF format for use with *AutoCAD*).

ARCHITECTURAL DESIGN Although our test drawing was not architecturally oriented, some of these packages may offer architectural functions (such as double-wall line drawing and architectural scaling) and architectural symbol libraries. The ability to handle typical architectural tasks, such as the extrusion of a 3-D model from a 2-D floor plan, is also a consideration.

THE RATINGS

0 = Unsuitable
1 = Poor
2 = Adequate
3 = Good
4 = Excellent

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The smallest footprint you'll find. At only 13.4" wide and 14.2" deep, microLaser offers what *BYTE* magazine calls, "an exquisitely small footprint and a compact design, destined for a cramped desktop."**

If you're not ready for PostScript yet, you can buy the standard microLaser for $1,799*. Then as your needs grow, so do microLaser's capabilities – without tools or technicians. Just add upgrade boards for PostScript software, more memory and optional interfaces. Or plug in microCartridges for additional fonts and emulations.

With all of this capability, why settle for less than the microLaser with PostScript?

Call us for additional information and the name of a dealer near you.

1-800-527-3500.

TEXAS INSTRUMENTS

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Within the last year Cadkey Inc. introduced a modified version of its *CADKey* for $3,195; Evolution Computing dropped the price of its 2-D CAD package, *FastCAD*, from $2,295 to $795; and Shroff Development Corp. slashed the price of its DOS version of *SilverScreen* to $995 when it introduced a new extended DOS version at $3,300.

You should no longer assume that a low price translates into a low-rent product. A low-cost product is no bargain if it doesn't have the features or support you genuinely need. But if you're in the broad class that doesn't need the power of an expensive CAD package, these products are definitely worth your consideration.

DesignCAD 3-D

Released in 1987 by American Small Business Computers, *DesignCAD 3-D* was one of the first and least expensive PC-based 3-D CAD programs available. At $399, its price is still right, especially since it includes many of the annotation, dimensioning, plotting, and text creation functions that its competitors supply only in their 2-D programs.

Using a menu-driven installation program, *DesignCAD 3-D* installs and runs easily on any IBM-compatible PC with 640K RAM. The program comes with 160 printer, 90 plotter, 89 video card, and 49 mouse and digitizer drivers. Because it calls for drivers on the fly, your CONFIG.SYS and AUTOEXEC.BAT files need not be altered, and you'll have the same amount of free RAM when you end *DesignCAD* as you had when you started it.

The program does not require a math coprocessor, but it will use one if your PC has it, and it makes full use of expanded memory as well. *DesignCAD* has a programming language similar to BASIC, which lets you create your own menus and digitizer tablet functions. The program also includes several script command files.

PART WAY THERE

The ability to dimension your 3-D models directly can be a real timesaver because it allows you to add dimensions once and pass them along to all orthogonal views you may generate from the model, rather than having to dimension each view separately. Unfortunately, though *DesignCAD 3-D* is reasonably complete in its basic dimensioning functions, it lacks such niceties as baseline, chained, diameter, and radius functions. Tolerance dimensioning is missing, and in terms of line types, your choice is solid, solid, or solid, with no control over line terminations.

Similarly, though *DesignCAD 3-D* lets you add text annotations to your models, you must do it one line at a time, making multiline annotation extremely tedious. You can import ASCII text blocks, but only after converting them to *DesignCAD* format outside the program, using a separate utility included with the package. You can't align text to the right, nor can you run it along an arc.

Finally, the program is unable to recognize arcs or circles for boundary selection during hatching operations: You must convert such objects into line segments before you can use them as boundaries.

Many of these missing features are found in *DesignCAD 2-D*, which can read the 2-D views exported from *DesignCAD 3-D*. Although *DesignCAD 2-D*'s feature set can't match that of *AutoCAD* or *CADkey*, it presents a respectable array of options. The differences between *DesignCAD 3-D* and its more-expensive rivals don't outweigh its cost advantage.

SOLID BASICS

Still, these minor detractions should not be allowed to obscure the real power that

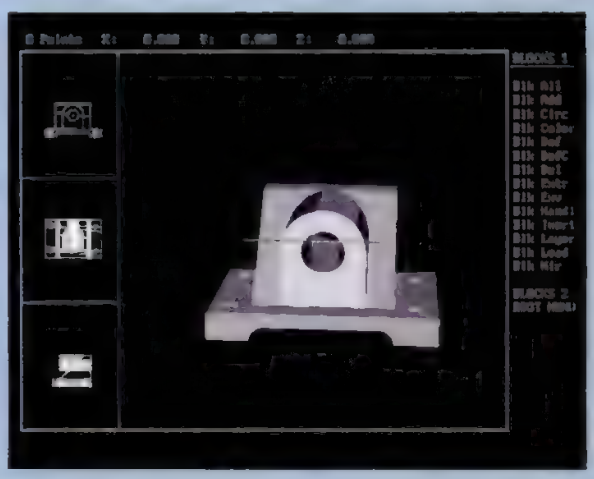
EDITOR'S CHOICE

• **DesignCAD 3-D**

Of the three low-cost 3-D CAD packages we review here, *DesignCAD 3-D* deserves our Editor's Choice. It's the only one with the features and capabilities of a full-fledged 3-D CAD program, offering Boolean operations, a good set of surfacing and shading options, and a full range of typical CAD functions.

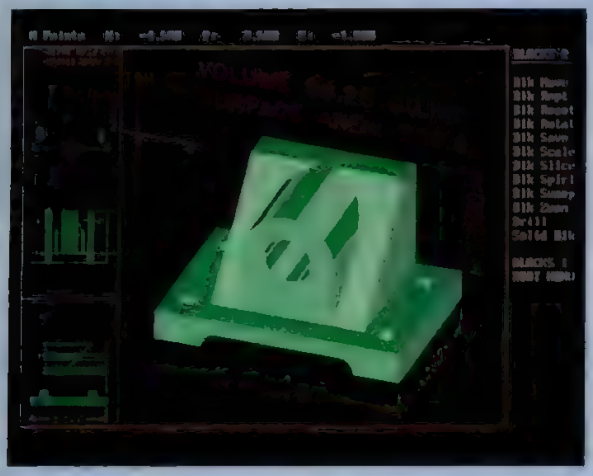
DesignCAD 3-D is the only package in our review that offers full associative and linear dimensioning as well as text annotation features; the other two require you to look to their 2-D counterparts for these CAD staples. Finally, *DesignCAD 3-D* is the only one of these products that imports .DXF files directly, an important consideration if you depend on other CAD packages for final detailing.

You won't find *DesignCAD 3-D* quite as robust as a full-cost CAD package, but it provides all the CAD power that many users will need for $399—a price that puts it within easy reach.



For only $399, *DesignCAD 3-D* gives you a full set of block commands. Note how this view of our fully surfaced test object is augmented by 2-D views of its front, top, and side.

There are some things PC Magazine doesn't seem to get tired of printing.



DesignCAD 3-D provides full dimensioning for 3-D objects, including the object's total volume. The program can include these measurements in each of its four view windows.

DesignCAD 3-D delivers. It has not only all the standard 3-D primitives (box, cylinder, cone, sphere, and hemisphere), but it also supports standard Boolean operations (union, intersection, and difference). Constructing our PC Labs' 3-D test model, which involved creating surfaces, extruding them into position, and cutting a center diameter with a Boolean operation, was a straightforward task that took less than an hour. *DesignCAD 3-D*'s performance was respectable on our tests, yielding a time between that of *Drafix 3-D Modeler* and *Generic 3D Drafting*.

A Coons patch command, which fits a surface over four connecting lines that can be straight or curved, circles or arcs, is one of *DesignCAD 3-D*'s more sophisticated surface-modeling techniques. You can also connect multiplanar rectangular surfaces to circles and back again. And you can create a transitional surfaces from an *xy* plane to a *zy* or *zx* plane, creating complex objects like exhaust manifolds and piping. These connect commands use ruled-surfaces algorithms and bend the surface at user-defined points. *DesignCAD 3-D* also has a connect-smooth command, which fits the surface to the chosen points using the smoothest possible curve. You can also use a spiral surface of revolution in which the perimeter of a surface is offset along the axis of rotation—very useful for creating spiral staircases, springs, and other spiralled objects. Although you cannot use these commands on solids, they are a powerful addition to your command arsenal.

FACT FILE
EDITOR'S CHOICE

DesignCAD 3-D,
Version 3.1
American Small Business Computers Inc., 327 South Mill St., Pryor, OK 74361; (918) 825-4844; FAX: (918) 825-6359.
List Price: *DesignCAD 3-D*, $399; *DesignCAD 2-D*, $299.
Requires: 640K RAM, 1.5MB of hard disk space, graphics adapter, mouse, DOS 3.0 or later. Math coprocessor and trackball or digitizer recommended.
In Short: Despite its low price, *DesignCAD 3-D* is a full-featured program with capabilities that go beyond those of programs that may cost many times its price. Boolean operations, multisource shading, plus built-in dimensioning and annotation features distinguish it from its low-cost competitors.

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SHADING AND HIDING

DesignCAD 3-D also has excellent shading and hiding features. Some wireframe 3-D CAD programs require you to "surface" an object before shading it—a slow, tedious, and error-prone process. With *DesignCAD 3-D*, you can shade your model with a single command. You can shade or hide one, two, three, or all four views, with up to eight light sources, and the process is fast and accurate.

DesignCAD 3-D's program logic does not allow open, or nonbounded, surfaces when drilling (placing holes into surfaces) or performing Boolean difference operations (removing volume from existing objects). Since it doesn't, shading and hiding become vastly easier both for you *and* the program. However, this trade-off causes the program to add an extra line when it "splits" the surface into two parts, representing the new boundary that is created between the two surfaces because of the hole drilled or shape differenced out of the solid. Although this split does not affect you or the drawing, it does affect the rendered results. When you plot a hidden view, the extra lines are plotted also, cluttering up an otherwise clearly rendered view.

FLAWLESS IMPORTS

DesignCAD 3-D defaults to four screen views: A large window shows the isometric view, while smaller windows down the left side show the top, side, and front views. These views can be switched between windows or turned off, but the windows' size cannot be changed, which somewhat limits your viewing flexibility. You can export any 2-D view into *DesignCAD 2-D*, and import it as well. Both .DXF and IGES import and export facilities are included at no extra cost, and you can also import HPGL files. *DesignCAD 3-D* was the only one of our three low-cost packages that imported a .DXF file with 3-D entities without a hitch.

Though it has its limitations, *DesignCAD 3-D* is a remarkably good value for its $399 price. In conjunction with *DesignCAD 2-D* (which offers more depth in its 2-D editing, dimensioning, and annotation capabilities and is well worth the additional $299 investment), it gives you a full range of 3-D CAD tools for a price that's thousands less than many competing packages.

Drafix 3-D Modeler

First released five years ago as *Designboard Professional* from MegaCADD, Foresight Resource Corp.'s $295 *Drafix 3-D Modeler* was one of the earliest inexpensive 3-D CAD packages. Designed to operate in conjunction with Foresight's 2-D CAD program, *Drafix CAD Ultra*, *3-D Modeler* doesn't offer such CAD staples as dimensioning, text annotation, and plotting. Unfortunately, it hasn't been upgraded in years, so while its brand-new 2-D counterpart, *Drafix CAD Ultra*, Version 4 ($395), is one of the most likable 2-D CAD programs around, *Drafix 3-D Modeler* itself comes off badly in comparison.

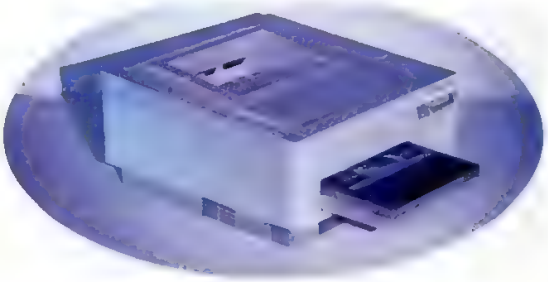
How great our printers are.

PC Magazine Editors' Choice Winners:

NEC Silentwriter2 Model 90
NEC Pinwriter P6200
NEC Pinwriter P6300

All things being

They're just about the same price. They're made by two very good companies. Yet, there's one thing that makes NEC's Silentwriter®2 Model 90 look much better on paper than Hewlett-Packard's LaserJet® III.



Hewlett-Packard LaserJet III

It comes with

Adobe® PostScript.®

NEC Silentwriter2 Model 90 with PostScript

So whether you're printing news-letters or flyers, sales sheets, stationery or shareholders reports, you'll have thirty-five different typefaces to help you create the most dazzling

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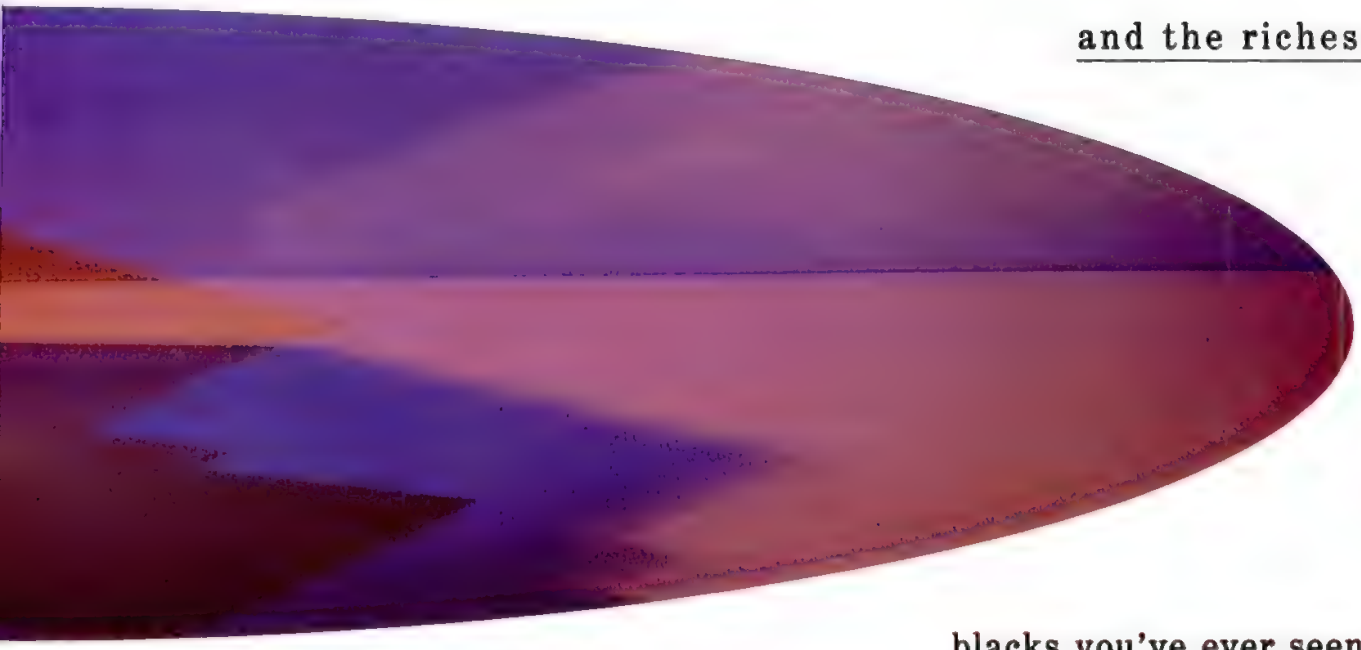
equal, they're not.

documents possible. Of course, you can get a Hewlett-Packard with PostScript, too. If you're willing to pay an extra thousand dollars.* Which you'd be crazy to do when you consider how much NEC's Silentwriter has going for it. Like screen fonts, a standard 2MB memory, an Apple Interface,® the ability to do envelopes, and the richest



blacks you've ever seen.

All things the Hewlett-Packard wishes it had. For product literature, call 1-800-NEC-INFO. NEC's Silentwriter2 Model 90. Take a close look and you'll find it has no equal.

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PC MAGAZINE EDITORS' CHOICE
November 13, 1990
SilentWriter2 Model 90

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to outperform any dot -

The integrated tear bar. Just one reason the P6300 is a cut above.

The large 80K buffer makes the P6300 all work and no wait.

The bottom feed slot permits trouble-free handling of multipart forms and labels.

Introducing the NEC Pinwriter P6300.

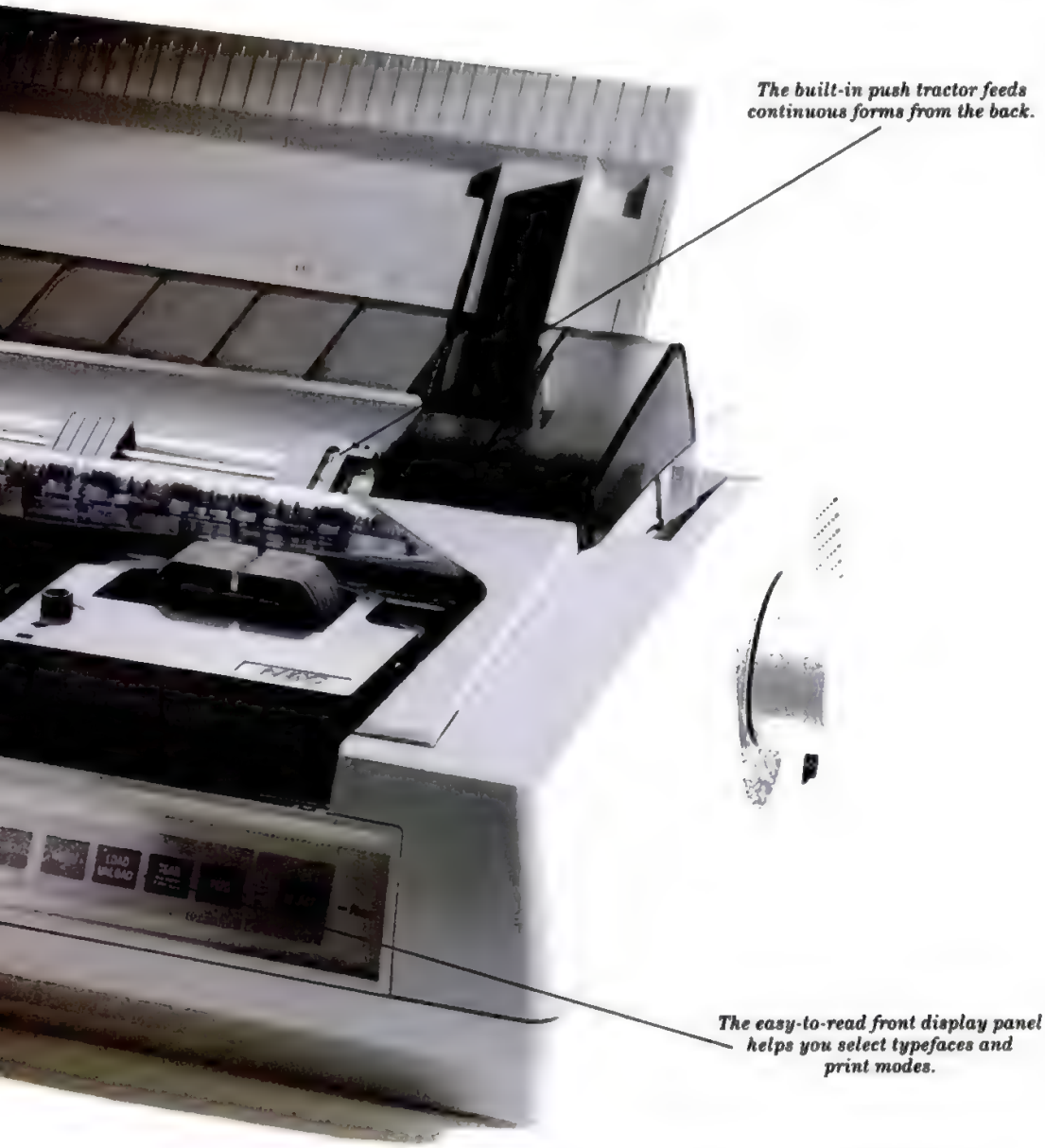
Only the Pinwriter* P6300 printer from NEC has the guts to deliver this much glory: Bold, black print quality that makes a statement with every line. Color graphics* that turn not only heads, but opinion. Eight standard fonts that let you do more, more impressively. And a Quick Gothic™ font that gives you letter-quality output up to two-thirds faster than anything in its class.

*Color kit sold separately.

NEC Technologies, Inc. 1414 Massachusetts Ave., Boxborough, MA 01719. 1-800-NEC-INFO. In Canada, 1-800-343-4418.

P6300 has the guts

matrix printer in its class.



PC MAGAZINE EDITORS' CHOICE
November 13, 1990
Pinwriter P6300

But the beauty of the P6300 (and its narrow-carriage brother, the P6200) extends beyond the printed page. Because they give you the ability to print on everything from 24-pound letterhead and envelopes, to continuous forms, labels, and card stock. Plus the ease to go from one to another, from one minute to the next.

It takes guts to say the Pinwriter P6300 is the best dot-matrix printer you can buy today.

It takes a lot less than you think to bask in its glory.

NEC

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MISSING PIECES

For one thing, *Drafix 3-D Modeler* cannot recognize relative or polar coordinates. If you have ever had to puzzle over the problem of determining the *x* and *y* coordinates of a point in relationship to an absolute reference point on a 2-D image, just imagine having only absolute coordinates when you're trying to place points on different, overlapping surfaces in 3-D space!

To make matters worse, *3-D Modeler* lacks an arc creation command. To create the arcs necessary in our PC Labs test model, we first had to draw a circle, then trace over the facets of the circle by placing reference points until we got the shape of the arc we needed.

This lack of basic features made even creating simple models such as our test object both tedious and inexact. In our case, we had to create the base of the test

2-D, 3-D, WHAT'S THE DIFFERENCE?

by Jeff Prosise

If you're wondering whether or not to make the move to 3-D CAD, you're not alone. Companies and designers everywhere are reassessing their CAD needs as 3-D packages proliferate at the low end of the cost spectrum—and as it becomes increasingly affordable to put the power of 3-D on one's desktop. But is it worth the cost of upgrading the 2-D systems already installed at your site? What does 3-D offer that 2-D doesn't? To arrive at an answer, it helps to understand the nature of the differences between 2-D and 3-D CAD.

2-D CAD turns your PC into an electronic drafting board. Objects on the screen have no inherent volume or thickness but are strictly collections of lines, curves, and other entities joined together to form dimensionally correct images. Still, 2-D CAD offers several strategic advantages over drawings crafted by hand. For example, in most applications—particularly those involving repetitive work such as applying electronics symbols to schematic diagrams—drawings can be created and edited in vastly less time than it would take to do the same drawings by hand.

Features such as associative dimensioning, which link dimensions to geometrical attributes such as the length of a line or diameter of a circle, make retroactive changes to a drawing faster and less labor-intensive. Data storage and retrieval permit information such as cost or part numbers to be associated with objects in the drawing and exported to spreadsheets and databases when it's time to estimate costs and bills of materials.

Some 2-D CAD programs have tools for generating additional orthographic views or isometrics from existing views of an object. This capability is often called 2 ½-D because such tools blur the otherwise sharp distinctions between 2- and 3-dimensional geometric construction.

THE 3-D DIFFERENCE

In 3-D CAD, each point is assigned a *z*-coordinate as well as an *x* and a *y*. Objects can be modeled as they appear in real life, not just as the flat projections created by 2-D CAD programs.

Among the most important of features of 3-D CAD is further reduced drawing time. The majority of today's manufacturing drawings still contain 2-D orthographic views of mechanical parts. 3-D CAD packages that permit orthographic views to be derived from 3-D models—a process called *instancing*—save time by reducing redundancy. In most 2-D packages, orthogonal views have to be generated separately. Many 3-D packages let you build a model of the part once, then pick as many views off the model as needed.

Another important feature of 3-D CAD is visualization. 3-D models have more power to convey design concepts than 2-D models, which rely more on the viewer's interpretive powers. Shaded images and photorealistic renderings increase visual impact even more. For example, Evolution Computing (Tempe, Arizona; 602-967-8633) raised the stakes in 3-D CAD this summer when it introduced a 3-D version of *FastCAD*, complete with a *FastCAD*-specific implementation of Pixar's *PhotoRealistic RenderMan* (see "FastCAD 3-D with RenderMan: The Shape of CAD to Come," *PC Magazine*, September 25, 1990, page 38). *RenderMan* is a highly sophisticated set of imaging tools that produces photographic-quality renderings from 3-D models. Other companies, including Autodesk (Sausalito, California; 800-445-5415) and Cadkey (Manchester, Connecticut; 800-654-3413), have announced similar products based on *RenderMan* specifications. Expect more high-end CAD vendors to follow suit in the near future.

OUTER LIMITS

Some 3-D CAD packages will perform complex engineering analyses that stretch the capabilities of even the most powerful PCs. Calculation of properties of solid objects like volumes, centroids, and moments of inertia are tasks 2-D packages, which work in planar space only, can't hope to do.

And, with the advent of coprocessors and fast memory, PCs can handle tasks similar to those of mainframe CAD systems. In the future, 3-D CAD will also help in such areas as meshing models for export to finite element analysis programs, feature-based parametric design, and animation. These features, available on high-end workstations today, are just beginning to work their way down to PCs.

Will 3-D CAD supplant 2-D CAD for everyone? No. Electrical engineers working with electrical schematics probably have no need for 3-D imaging. Nor do architects working with floor plans and two-dimensional elevations. Most of the CAD work that goes on in corporate America still takes place in two dimensions, and most CAD systems are still being used as electronic drafting tools—a less radical departure from the conventional than the idea of fully integrated 3-D drafting, design, and manufacture. For the most part, it is hard to tie a dollar figure to the increased productivity you'd expect to see from using 3-D CAD instead of 2-D. Nevertheless, as the three low-cost 3-D CAD packages reviewed here prove, the bottom line is getting lower every day. ■

Now that you've seen our printers on paper, why not take a closer look?
Call 1-800-NEC-INFO for more information. We're sure that once you do, you'll never get tired of printing, either.

NEC

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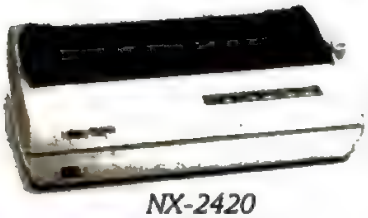
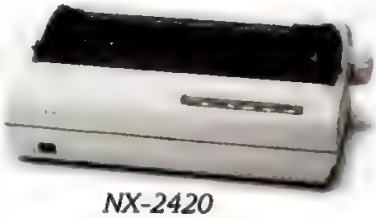


NX-2420 RAINBOW

NX-1020 RAINBOW

NX-1001 MULTI-FONT



NX-2420 MULTI-FONT

For a while there, it was beginning to look like there would never be a dot matrix printer versatile enough to be a real jack-of-all-trades. But no more. Now, for the first time ever, there's a new series of printers designed to bring you big-business performance at a small-business price.

Star's new NX Series printers have all the write stuff you need to get the job done and then some. Let's start with multiple fonts. Each of the four NX Series printers comes equipped with an incredible variety of fonts, sizes and enhancements, which, when combined, put thousands of printstyles at your fingertips. And all offer high resolution graphics for more professional-looking presentations.

Advanced paper handling features (which are optional on most printers)

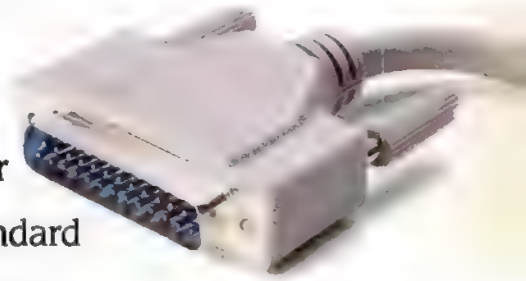
Multiple fonts

Advanced paper handling

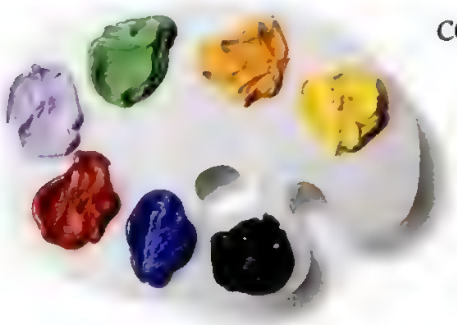
are standard with Star. The switchable push/pull tractor makes changing paper paths a snap—a feature that's especially handy when you're printing a lot of hard-to-manage forms. Plus, convenient paper parking lets you feed single sheets through at the touch of a button—without removing or wasting continuous-feed paper.

User-friendly control panel

NX printer control panels are designed for the ultimate in user-friendliness. You can easily select up to 14 of the most commonly used functions. And an Electronic Dip Switch Mode lets you customize the control panel with up to 15 of your own power-on settings.


Compatibility

Star's NX printers are Epson and IBM* compatible for use with most off-the-shelf software packages. Their standard parallel centronics interface with optional serial-to-parallel converter makes them simple to use with most personal computers. All are capable of high-speed, bi-directional printing at extremely low noise levels. And the two *RAINBOW* models—the NX-1020 and NX-2420—even offer printing in seven vibrant colors.


Color printing

Star has one of the largest selections of printers available for small businesses. So make sure you take a look at our new line of NX printers. They're engineered to give you the price-performance of a lifetime. To find out where you can get all the write stuff from Star, call 1-800-447-4700 now.

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2-YEAR LIMITED WARRANTY

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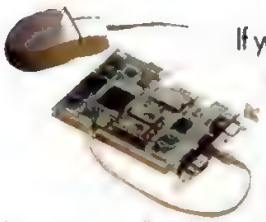
VGA*WONDER+*
FASTER THAN VRAM



If you're about to buy a graphics card, make sure you don't get fleeced. And if anyone tells you that VRAM is the fastest, he's pulling the wool over your eyes. VGA*WONDER+** is what ewe...er...you need.

While others follow, VGA*WONDER+* leads the flock with remarkable resolution, fabulous colors and outstanding value. VGA*WONDER+* offers an optimized architecture including fast 16-bit bus support and fast page mode memory which assures maximum speed...that's faster than VRAM and other VGA cards. Based on ATI's original award-winning VGA*WONDER** and available in 256K and 512K versions, you receive:

- High resolution non-interlaced and interlaced 1024×768 plus 800×600 graphics;
- 100% register-level compatible in all modes;
- Extensive drivers support including Windows 3.0*, Presentation Manager* and AutoCAD* Display List;
- Ergonomic 70Hz refresh rate in 1024×768, 800×600 and 640×480;
- Easy, switchless installation;
- Free Microsoft* compatible bus mouse;
- And much more.

With VGA*WONDER+*, performance is in the baaaaaaag.

For more information, contact your supplier or

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LOW-COST 3-D CAD PACKAGES: SUMMARY OF FEATURES

Products listed in ascending price order

All of these 3-D CAD packages support basic 3-D operation, including commands for extrusion, hidden line removal, definable viewpoints, and variable perspectives. All let you select objects or groups of objects, and all have commands to let you rotate, resize, and join the endpoints of objects. However, just how much each program relies upon its 2-D CAD counterpart to handle actual CAD basics such as dimensioning, annotating, drawing, and entity editing varies with each package.

	Drafix 3-D Modeler	Generic 3D Drafting	DesignCAD 3-D
	$295	$349	$399
DRAWING COMMANDS			
Freehand sketching	❑*	❑	■
Snap	■	■	■
Grid	■	■	■
Object	■	❑	■
Nearest	■	■	■
Endpoint	■	■	■
Midpoint	❑*	■	■
Center of circle	■	■	■
Point	■	■	■
Circle quadrant	❑*	❑	■
Intersection	❑*	❑*	■
Perpendicular	❑*	❑*	■
One-time	■	❑	■
Variable tolerance	■	■	❑
Variable aspect ratio	■	■	■
Orthogonal	■	■	■
Grid	■	■	■
Variable size	■	❑	■
Variable aspect ratio	■*	❑	❑
Variable angle	❑	■	❑
Isometric	❑	■	❑
EDITING COMMANDS			
Selection	■	■	■
Objects	■	■	■
Groups of objects	■	■	■
Windows	■	■	■
Number of multiple windows	4	None	None
Last object	■	■	❑
By entity type	■	❑*	❑
Erase	■	■	■
Unerase	■	■	■
Animated movement	❑	■	■
Copy	■	■	■
Arrays	❑*	■	■
Rectangular	❑	■	❑
Circular	❑*	❑*	■
Mirror	■	❑*	■
Rotate	■	■	■
Endpoint join	■	■	■
Resize	■	■	■
Fill	❑*	❑*	❑*
Break/trim	❑*	■	■
Lines	❑*	■	■
Circles/arcs	❑*	■	■
Other entities	❑*	❑*	■
Extend	■	❑*	■
Fillet	❑*	❑*	■
Chamfer	❑*	❑*	■
Segment line/arc	❑*	❑	❑
Undo	■	■	■
3-D FEATURES			
Boolean operations	❑	❑	■
Polygons	■	■	■
Faces	■	■	■
Extrusions	■	■	■

Editor's Choice ■–Yes ❑–No
* This feature is supported in the 2-D version.

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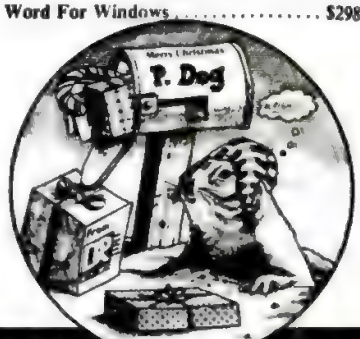

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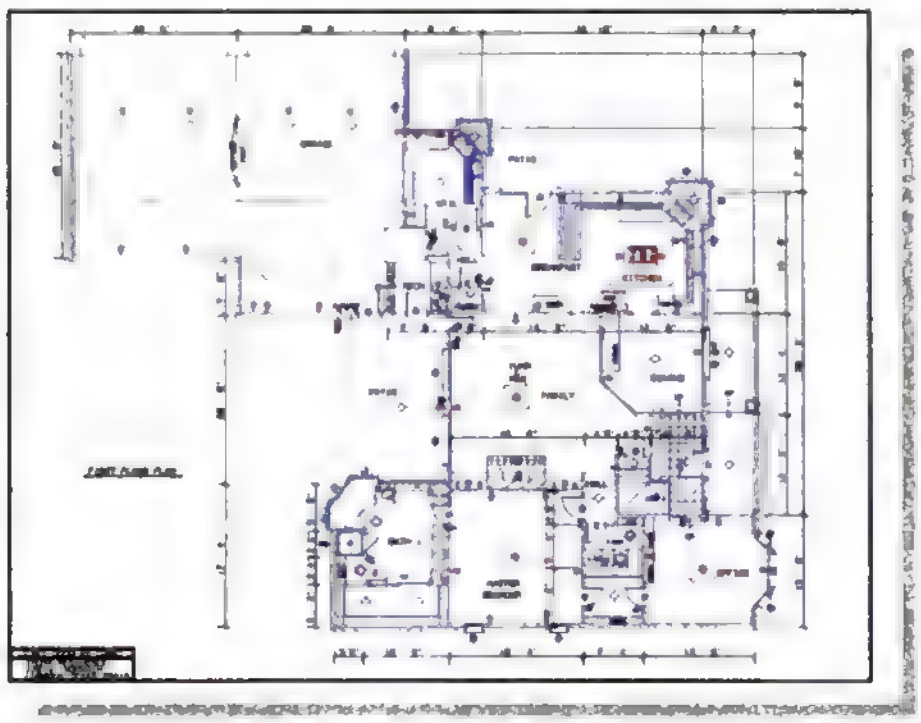

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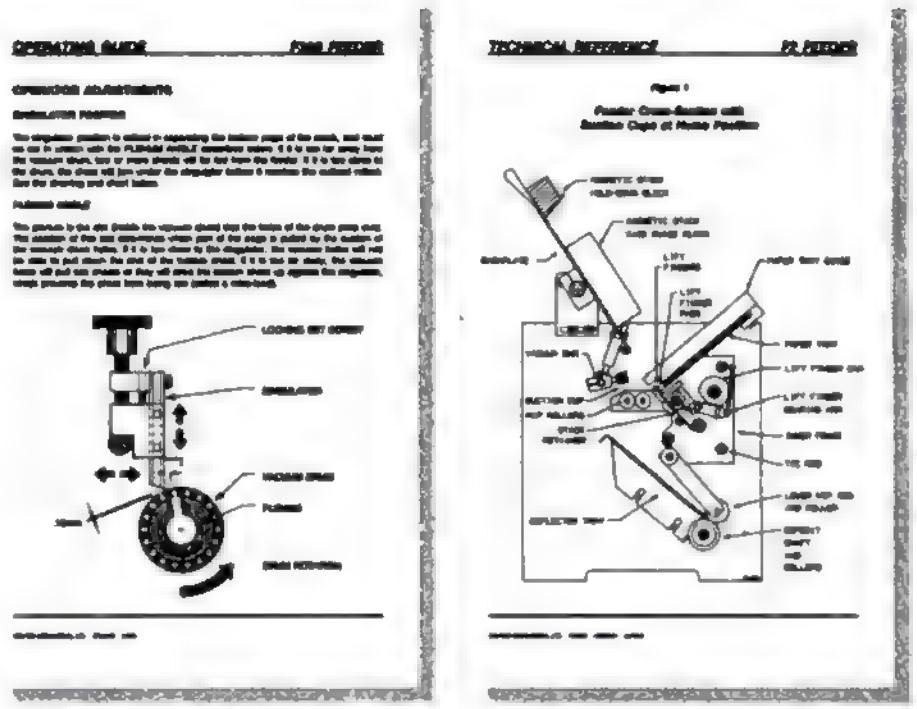

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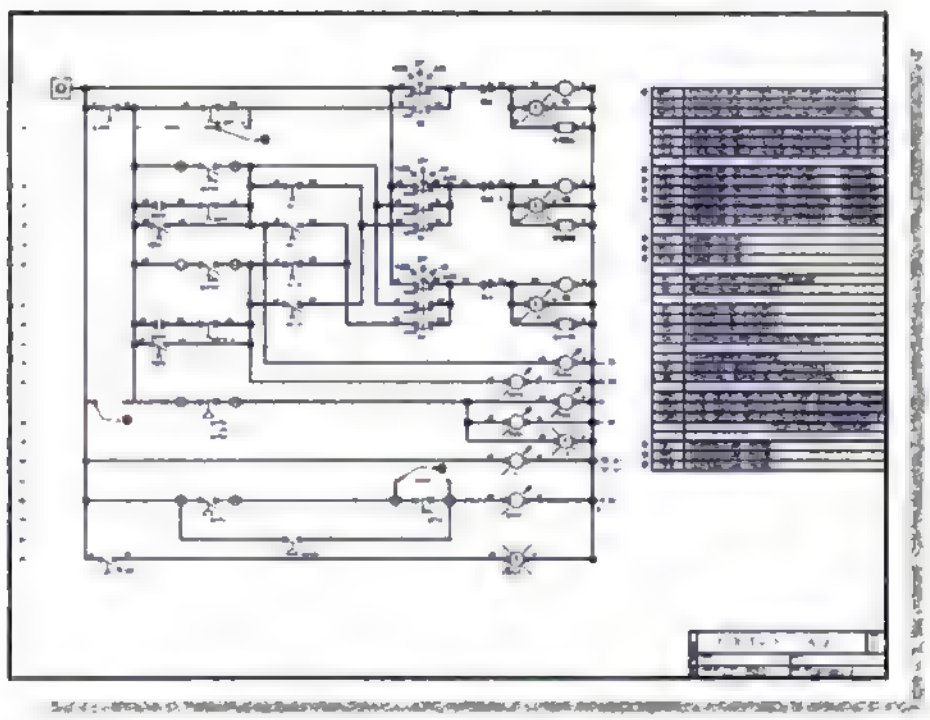

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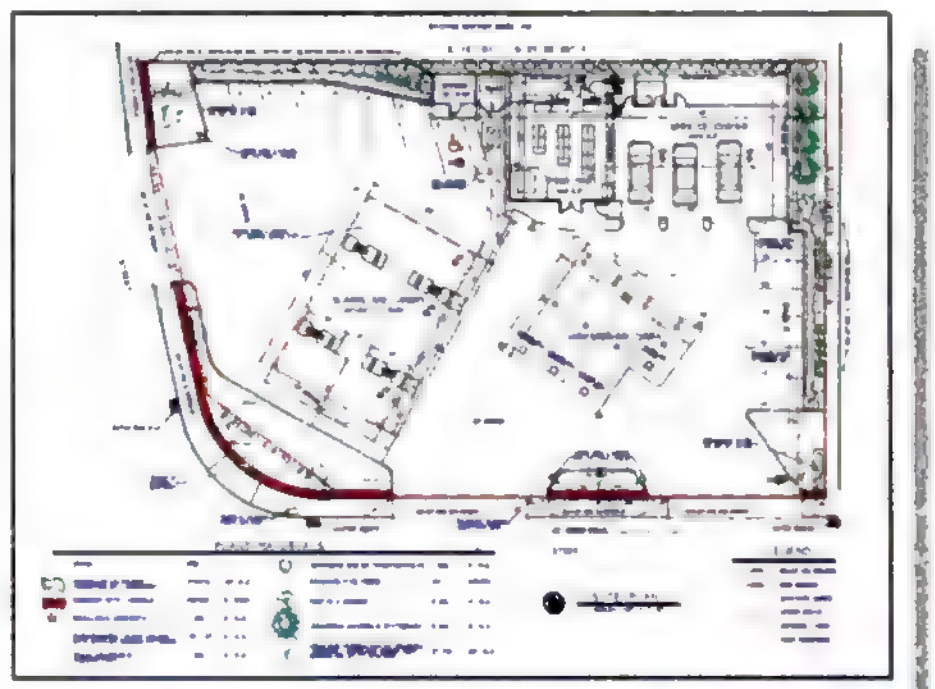

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LOW-COST 3-D CAD PACKAGES: SUMMARY OF FEATURES

	Drafix 3-D Modeler	Generic 3D Drafting	DesignCAD 3-D
3-D FEATURES (CONT'D)			
Hidden line removal	■	■	■
Shaded images	□	■	■
Definable viewpoints	■	■	■
Perspective viewing	■	■	■
SURFACING OPTIONS			
Surfaces of revolution	□	■	■
Ruled surfaces	□	□	■
Tab surfaces	□	□	■
Coons patch surfaces	□	□	■
Vertex-defined surface	■	□	■
MEASURE			
Rectangular coordinates	■	■	■
Absolute	■	■	■
Relative	■	■	■
Polar coordinates	■	■	■
Absolute	■	■	□
Relative	□*	■	■
Line	■	■	■
Automatic polygon closing	■	■	■
Automatic continuation of line command	■	■	■
Variable width	□*	□*	□*
Architectural only	■	□	□
Point	■	■	■
Circle	■	■	■
Center/radius	■	■	■
Center/diameter	■	□	■
3-point	□*	■	■
2-point	□*	■	■
Arc	□*	■	■
3-point	□*	■	■
Ellipse	■	□*	■
Multipoint curve	□*	□*	■
Spline curve	□	□*	■
Bezier curve	□	■	□
Polygon	■	■	■
Polyline	■	□	■
Distance	■	■	■
Area	□*	□*	■
Perimeter	□*	■	■
DISPLAY CONTROLS			
Zoom	■	■	■
By magnification factor	□	■	■
By window	■	■	■
Restore original view	■	■	■
Dynamic zoom	■	□	□
Dynamic pair	■	□	□
Pan	■	■	■
Drag	□	■	□*
Displays cursor coordinates	■	■	■
Adjustable units	■	■	■
Projection aids	□	■	■
Cursor icons	■	■	■
Page display	■	□	■
Multiple views	■	□	■
DIMENSIONING			
Associative	□*	□	■
Linear	□*	□*	■
Horizontal	□*	□*	■
Vertical	□*	□*	■
At an angle	□*	□*	■

Editor's Choice ■–Yes □–No
* This feature is supported in the 2-D version.

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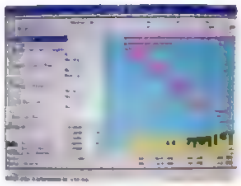

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FACT FILE

***Drafix 3-D Modeler*, Version 3.02b**
Foresight Resources Corp., 10725 Ambassador Dr., Kansas City, MO 64153; (816) 891-1040, (800) 231-8574; FAX: (816) 891-8018.
List Price: *Drafix 3-D Modeler*, $295; *Drafix CAD Ultra* (Version 4), $395.
Requires: 512K RAM (640K recommended), graphics adapter, mouse, DOS 2.1 or later. Math coprocessor and trackball or digitizer recommended.
In Short: *Drafix CAD Ultra*—the recently updated 2-D part of this combination—is ultra convenient and packed with features, but the 3-D side is a weak companion. *Drafix 3-D Modeler*'s lack of important 3-D modeling features, such as shading and Boolean operations—plus its inability to import files from *Drafix CAD Ultra*—present serious obstacles for the 3-D CAD user.

CIRCLE 613 ON READER SERVICE CARD

object as five separate objects, then manipulate those objects into position after constructing a template. Besides the time it requires, this build-your-own-template approach costs in terms of accuracy. Because the two 180-degree arcs that make up our test model's holes, for instance, aren't mathematically defined curves but are actually line segments based on pick-points, they can be only as accurate as the tracing of the circles used to create them.

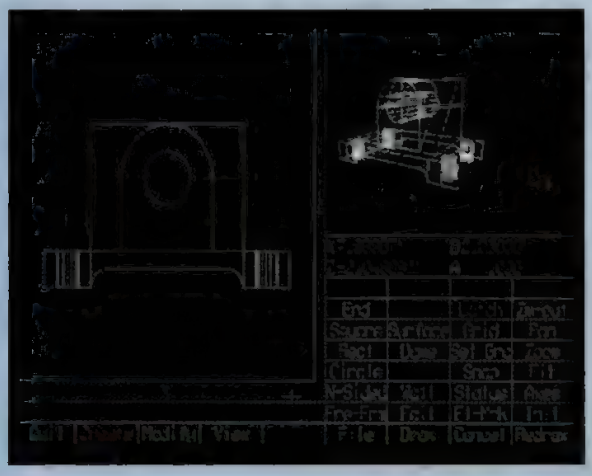
Yet another major drawback of *Drafix 3-D Modeler* is its failure to include even basic shading capabilities. Although you can purchase *Megashade*, a $395 shading package, from MegaCADD (Seattle, Washington; 800-223-3175), this hardly seems convenient when a package such as *DesignCAD 3-D* offers shading as a menu command.

THE 2-D FIX

To be fair, Foresight Resources views *3-D Modeler* as a conceptual tool rather than as a precise mechanical modeler. And once we exported out test model to *Drafix CAD Ultra*, we were able to convert its segmented lines into true arcs and circles relatively easily. Ease of use, in fact, is the strong point of Foresight's well-designed 2-D CAD package. Unlike most CAD programs, its user interface resembles that of a drawing package, and its latest version (Version 4) offers *Lotus 1-2-3*-like one-letter menu commands to speed expert users. Add to this an expanded set of features, including associative dimensioning, visible symbol selection, and an integrated utilities menu (which includes *Otto*, Drafix's file conversion utility) and you have a strong contender in the low-cost CAD market.

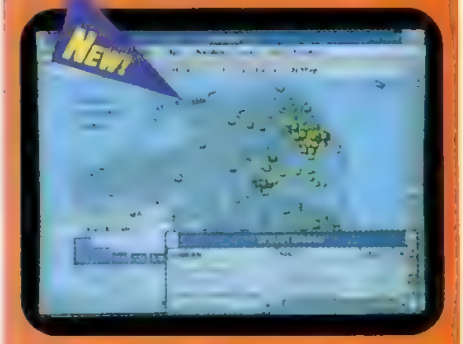
Version 4 also includes *Cadapult*, a utility that extracts text and attributes and translates them into ASCII, *Lotus 1-2-3*, or *dBASE* formats.

Unfortunately, where *Ultra* shines,



***Drafix 3-D Modeler* won't make arcs for you; instead, you'll have to create arcs from points picked on a reference circle. The inexact results this yields are apparent in this 2-D view of the front of our test image.**

SEE YOUR DATA!



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LOW-COST 3-D CAD PACKAGES: SUMMARY OF FEATURES

	Drafix 3-D Modeler	Generic 3D Drafting	DesignCAD 3-D
DIMENSIONING (CONT'D)			
Rotated text	□*	□*	■
Baseline (stacked)	□*	□*	□*
Chained	□*	□*	□*
Diameter	□*	□*	□*
Radius	□*	□*	□*
Extension lines	□*	□*	■
Line terminators	□*	□*	■
User-definable	□*	□	□*
Tolerances	□*	□	□*
Leaders	□*	□*	■
LINE TYPES			
Solid	■	■	■
Dashed	□*	■	□*
Center	□*	■	□*
Phantom	□*	■	□*
SYMBOLS			
Pick from menu	□*	■	■
Named	□*	■	■
Scale on insertion	□*	□*	■
Rotate on insertion	□*	□*	■
Mirror on insertion	□*	□*	□*
Attributes	□*	□	■
TEXT FEATURES			
Justification	□*	□*	■
Center	□*	□*	■
Left	□*	□*	■
Right	□*	□*	■
Auto-aligned	□*	□	■
Different fonts	□*	□*	■
Variable aspect ratio	□*	□*	□*
Can run along arc	□	□	□*
PLOTTING CONTROLS			
Variable sizing	□*	■	■
Variable orientation	□*	■	■
Can plot part of drawing	□*	■	■
By window	□*	■	■
By layer	□*	■	■
By attribute	□*	□	□
Automatic scaling	□*	■	■
Spooling	□	□	□
Plot file optimization	□*	■	□*
Dot matrix plot	□*	■	■
Laser printer plot	□*	■	■
Maximum number of layers	256*	256	21
Maximum number of colors	16*	256	256
Maximum number of pens	16*	256	256
Line types	□*	■	□*
Hatching patterns	□*	□*	□*
FILE MANAGEMENT			
Can derive 2-D images from 3-D models	■	■	■
Imports/exports IGES	□*/□*	□*/□*	■/■
Imports/exports .DXF	□*/□*	Optional	■/■
MISCELLANEOUS FEATURES			
Command scripts	□	□*	■
Programming language	□	□	■
Programmable screen menus	□	■	■
Programmable tablet menus	□	■	■

□–Editor's Choice ■–Yes □–No
* This feature is supported in the 2-D version.

ENDS

3-D Modeler falls far short; although *3-D Modeler* can export a drawing to the 2-D package, it cannot export .DXF files to or from the 2-D program, making it impossible to pick off views for easy transitions from 2-D to 3-D. Worse, it cannot import any files at all.

BETWEEN WINDOWS

Drafix 3-D Modeler itself has a few good points. It gives you both orthogonal and perspective views during entity creation, and a four-view window for object editing and modification. And although it lacks Boolean operations and a surface-of-revolution command, it does create patched surfaces. Its dome creation command (which you can also use to create spheres) offers a variable degrade range from 1 to 180 degrees.

> *3-D Modeler* allows you to create curved surfaces using what Drafix calls "surface point control" to create domes or other variable curves in the plane.

You can extrude any face in a 3-D model, and faces can be sliced or extruded to a plane. In addition, *3-D Modeler* allows you to establish curved surfaces from planes using what Drafix calls "surface point control." You can pick numerous points on the top of a cube, for example, and create a dome or other variable curves in the plane.

Another nice design feature is the ability to perform editing operations in multiple viewing windows. Because the front, side, and top window views are all active during editing, you can issue an editing command in one window, move the cursor into another window to pick a point or attach on a line, then continue on in the first window—a process that significantly reduces errors. Any entity you pick becomes highlighted in all windows, and if

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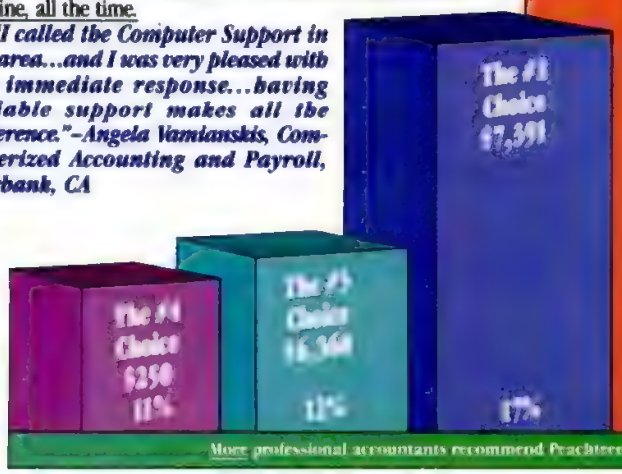

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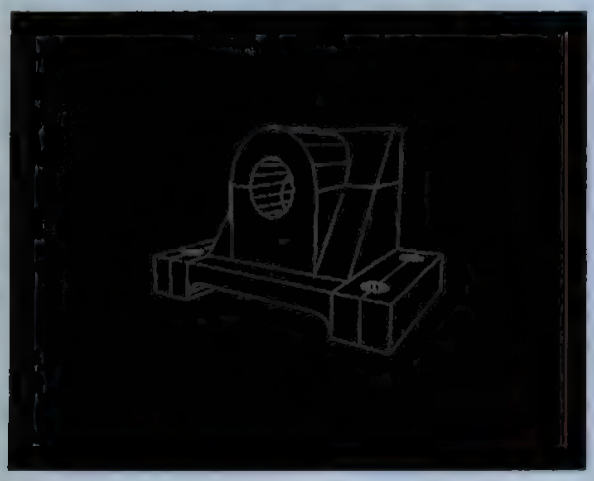


Since *Drafix 3-D Modeler* lacks shading commands, you'll have to purchase *Megashade*, a $395 option from MegaCADD, if you want to shade your wireframe 3-D model.

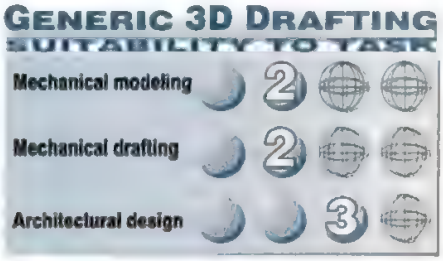
you should pick the wrong entity, you can deselect the originally selected face and highlight another face on the same object with a single command.

All in all, though, *Drafix 3-D Modeler* falls far behind its more-recent competitors. Many of the commands and features it lacks are standard offerings in other 3-D packages, and you'll find your work goes more smoothly and accurately with one of them. The quality of its *Drafix CAD Ultra* doesn't make up for *Drafix 3-D Modeler*'s manifest deficiencies in 3-D work, and until some basic problems are addressed, it's hard to justify the purchase of this old-timer.

Generic 3D Drafting

The first release of *Generic CADD Level 1* was an instant success, in part because of its remarkable resemblance to *AutoCAD*. Granted, it lacked *AutoCAD*'s brute power and many of its features, but tens of thousands of users found that they could have everything they required in a CAD package for less than $200.

Generic Software has extended its products' capabilities since then, but it now takes a modular approach. Although you can use *Generic 3-D Drafting* ($349) alone, it really isn't complete without its 2-D sibling, *Generic CADD Level 3* ($395), which supplies the dimensioning, text, hatching, and fill commands that you need in a full-featured CAD system. DXF conversions require yet a third module (an $89 program called *AutoConvert*), so the list price of the configuration we actually required to complete our tests was $843.95. The program's hardware requirements are refreshingly modest—just an XT with 640K of RAM and a mouse or digitizer, though you'll probably want a more robust system for serious work. A math coprocessor is supported but it is not required.

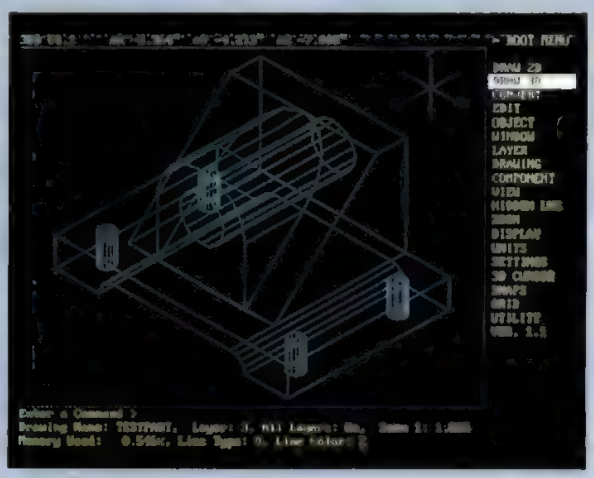


FAMILIAR GROUND

Generic CADD Level 3's user interface still looks and acts like *AutoCAD*. If you are comfortable with *AutoCAD*'s basic approach—a menu tree displayed on the right hand side of your screen, a status line across the top, and a command line on the bottom for direct keyboard input—you'll get cozy with *Generic CADD* in short order. Although the 2-D and 3-D packages are separate programs with separate files and installation routines, you fortunately don't have to learn two different interfaces: Generic Software has made them very much alike, and it's easy to jump from one to another. Like *AutoCAD*, Generic's CAD programs let you add commands to existing menus and create custom menus and submenus. You can write fully interactive scripts using Generic Software's ASCII-text batch language, GenCAD.

Generic 3D Drafting improves on *AutoCAD* with its so-called "tracking" capability—a big help in constructing 3-D objects. In most 3-D packages, positioning the cursor in 3-D space on your two-dimensional monitor can be a tricky process: You have to make sure that you're on the correct surface (neither above nor below it) when you're adding geometry or editing your model. *Generic 3D Drafting* solves this problem by letting you start a command using a known corner or intersection on your model as a reference point. The cursor is then "tracked" to the correct 3-D coordinate; once there, click your mouse, and the object is properly located. Once you've learned how to use this feature, it's hard to locate geometry in the wrong place.

Unfortunately, you cannot open multiple viewing windows on your model. Although you can define any view or position your object in several predefined views, you can only see one view at a time on the screen.



Generic 3D Drafting's unique tracking feature lets you easily pick a point on any of your three-dimensional object's surfaces—in general, not a simple task.

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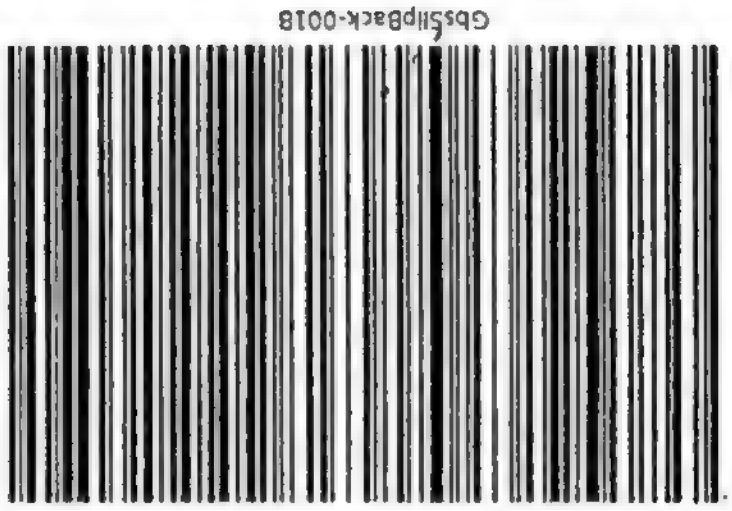
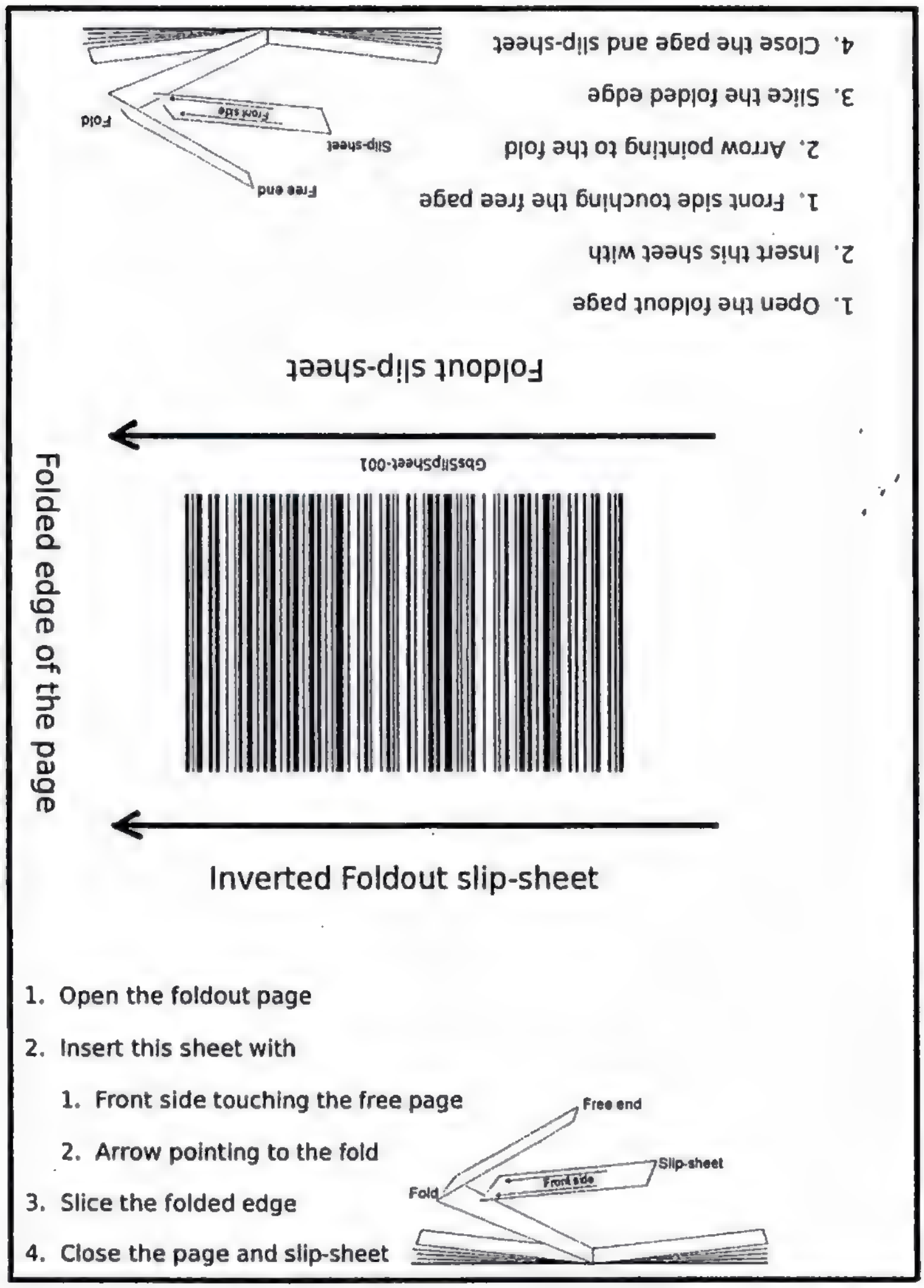


Back

1. Follow instructions on the other side


Folded edge of the page
GbsSlipSheet-001
Foldout slip-sheet
1. Open the foldout page
2. Insert this sheet with
1. Front side touching the free page
2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet
Free end
Slip-sheet
From side
Fold
Inverted Foldout slip-sheet
1. Open the foldout page
2. Insert this sheet with
1. Front side touching the free page
2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet
Free end
Slip-sheet
Front side
Fold

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Reason: Maximum compatibility for both low and high density.

SONY Monitor: Sony 1304
Spec: Non-interlaced at 1024 x768 DOT Pitch .25
Reason: Non-interlaced for a FLICKER-FREE 1024 x 768 screen. Tightest dot pitch available. Clearest screen. Easiest on the eyes.

ARCHIE Graphics Adapter: Pro-Designer II
Spec: Expandable to 1 MEG; Non-interlaced at 1024 x 768
Reason: To allow 256 colors at 1024 x 768, as opposed to a 512K card only getting 16 colors. Non-interlaced at 1024 x 768.

MITSUBISHI ELECTRONICS Hard Drive/Controller: Mitsubishi MR 535 Hard Drive
Spec: 65 MEG; 24 MS Access Time.
Reason: A name that assures reliability. One of the fastest access times on the market for a drive of comparable size.

adaptec Adaptec 2372C Controller
Spec: 8K Cache on Board
Reason: The fastest RLL data transfer rate on the market.
Data transfer Rate: 1020 kilobytes per second.

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Spec: Non-interlaced at 1024 x 768 Dot Pitch .28
Reason: Spectacular display for the serious CAD and graphics application users. Tightest, sharpest Dot pitch for 16" monitor.

MICROPOLIS Hard Drive/Controller: Micropolis 1654-7 Hard Drive
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150,000 Hr. MeanTime BetweenFailure
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adaptec Adaptec 2322D Controller
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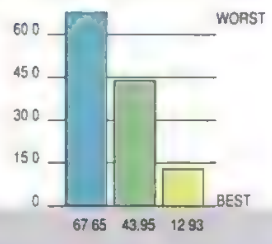
PERFORMANCE TESTS: LOW-COST 3-D CAD PACKAGES

***Drafix 3-D Modeler* performed the fastest on our test suite, but it was the only one of the three packages that couldn't execute our tests without its 2-D counterpart, *Drafix CAD Ultra*, Version 4.**

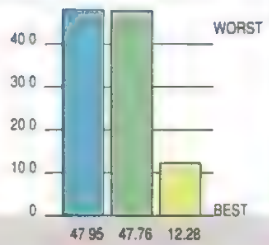
Full-Screen Generation — Elapsed Time (seconds)

The **Full-Screen Generation** test measures the time it takes to draw a two-dimensional .DXF file, loaded from disk to bypass any image buffering schemes. Timing begins as soon as the first entity appears and ceases when the last entity has been completely drawn and the user has regained control of the PC.



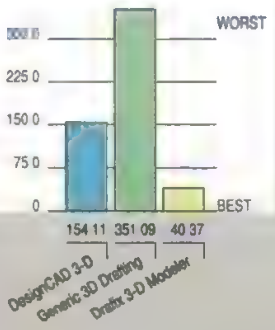
Mass Entity Deletion — Elapsed Time (seconds)

The **Mass Entity Deletion** test measures the time it takes to erase selected entities in a two-dimensional .DXF file using each CAD package's Group Select procedure. Timing begins upon execution of the delete command and stops when the last entity appears and the user has regained control of the PC.



Hidden Line Removal — Elapsed Time (seconds)

The **Hidden Line Removal** test measures how long it takes to remove multiple hidden lines from a three-dimensional drawing with several overlapping surfaces. Timing begins upon execution of the Remove Hidden Lines command and ceases when the drawing is complete and the user has regained control of the PC.



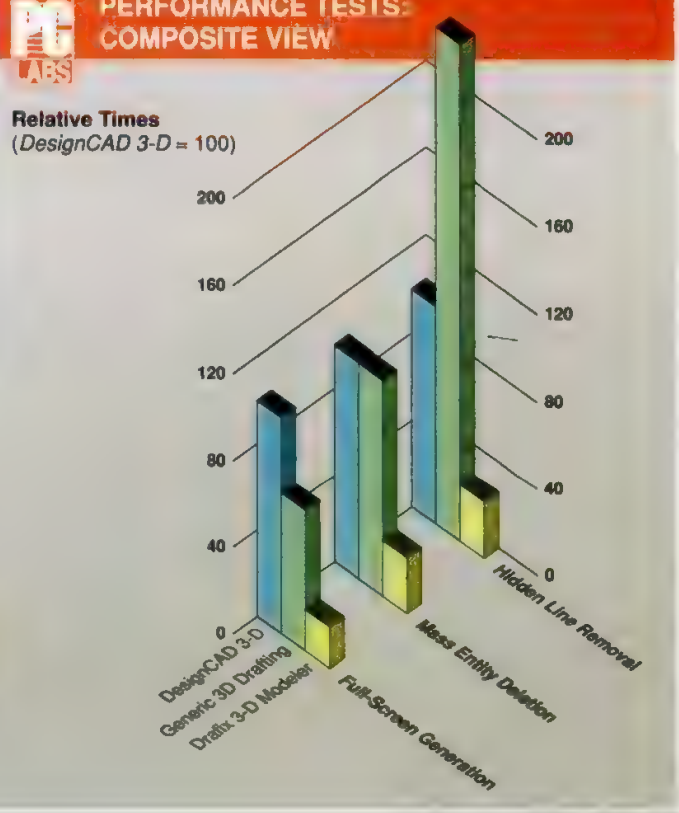
All tests were performed on a Compaq Deskpro 386/25 equipped with an Intel 80387 math coprocessor, 4MB of RAM (3MB configured as expanded memory), and a 60MB hard disk drive.

The speed of hidden line removal, one of the true tests of a 3-D CAD package, varies with the algorithm used by the package and the nature of the hidden surfaces in the drawing. For example, a drawing containing a large number of overlapping objects with only a few surfaces in each (such as cubes) will perform differently under a given algorithm than will one with fewer overlapping entities containing a large number of surfaces (such as a complex surface of revolution). Of course, speed isn't the only concern: The algorithms also vary in accuracy.

Our PC Labs test image, which contains numerous overlapping entities with few surfaces on each, favors *Drafix 3-D Modeler*'s modified Roberts algorithm, which ignores completely hidden surfaces; on the other hand, the package seems to have missed several hidden lines. *DesignCAD 3-D*'s scan-line algorithm, a method similar to that used by drawing packages, performs respectably, and *Generic CAD 3D Drafting*'s method is very slow. Neither package missed any hidden lines, however. But because *Generic 3D Drafting* could not import a three-dimensional .DXF file properly and because *Drafix 3-D Modeler* could not import any files at all, the image for the Hidden Line Removal test had to be generated within each package. As a result, the test file was slightly different in each one.

Furthermore, because *Drafix 3-D Modeler* cannot import files, and because reproducing the two-dimensional test image (a 20-by-28 matrix of geometric objects embedded within each other) was nearly impossible due to *Drafix 3-D Modeler*'s lack of block cut-and-paste, the timings for the Mass Entity Deletion and the Full-Screen Generation tests were performed for this package within *Drafix CAD Ultra*–one of the reasons behind its comparatively fast times on these tests.

PERFORMANCE TESTS: COMPOSITE VIEW



WHERE'S THE BOOLEAN?

Generic 3D Drafting has a good set of standard commands for producing geometric primitives such as boxes, cylinders, pyramids, and cones, though it's missing sphere and hemisphere creation commands. It has surface-of-revolution and extrusion commands as well. But it lacks Boolean operations, which often forces you to take several additional steps in constructing 3-D objects. It also lacks ruled, tab, and Coons patch surface commands. Although *Generic 3D Drafting*'s surface-drawing capabilities are adequate, we found that they, too, suffered from the program's overall slowness.

> *Generic 3D Drafting* has a good set of commands for producing primitives such as boxes, pyramids, and cones.

We constructed our test model entirely in *Generic 3D Drafting*, and Boolean operations would definitely have made this easier. Still, with *Generic 3D Drafting*'s tracking command, the process was almost always smooth. The only rough spot was extruding the arch to the slanted plane of the cube. Although adding points on the slanted surface was possible because of *Generic 3D Drafting*'s 3-D tracking, each facet line then had to be extended to the surface point individually.

Like *DesignCAD 3-D*, *Generic 3D Drafting* does not force you to define surfaces before shading objects. Eliminating this tedious and error-prone step saves many frustrating moments. The rendering routine has a single positional light source that can be toggled off and on and can be projected from any viewpoint. Shading operations are remarkably fast: Almost as soon as the shade command is picked, the screen blanks and your objects are rendered. The results are respectable even on a 16-color VGA adapter. You can save completed, rendered objects in pixel format for slide show presentations, and those files can be saved as .PCX, TIFF, .IMG, and *Microsoft Paint* files and in *Generic 3D Drafting*'s native .GX2 formats.

Generic 3D Drafting was a bit slow on our performance tests, partly because of its design. For example, its speed on the mass entity deletion test was hampered by the way it first "grays out" the marked entities on the screen, then deletes them.

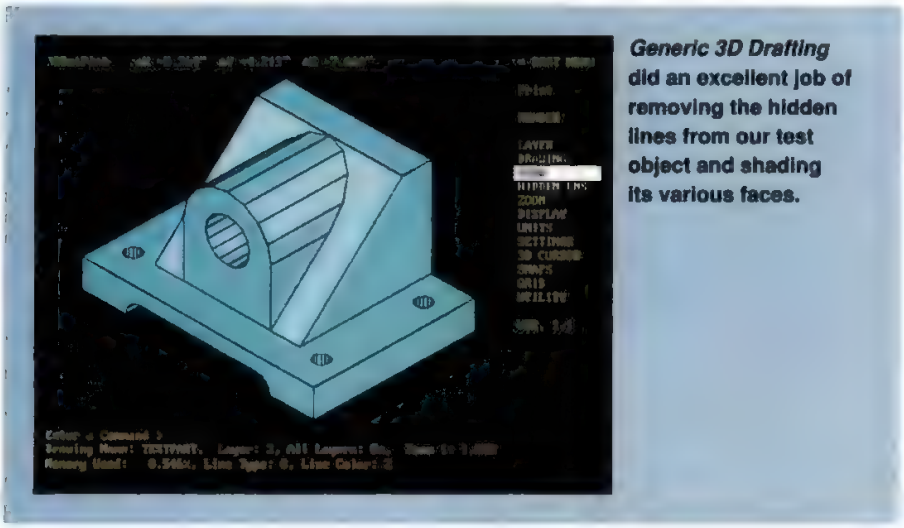
Generic 3D Drafting's hidden line removal (which creates a "snapshot" view of your object) is exceptional: Pans and zooms on hidden-line views are instantaneous, and your hidden lines *stay* hidden, unlike those of *DesignCAD 3-D* and *Drafix 3-D Modeler*.

TEAMWORK

Because *Generic 3D Drafting* contains no dimensioning or annotation functions, producing drawings requires you to export 2-D views of your model into *Generic CADD Level 3* or another CAD package using the optional *AutoConvert* utility ($99.95). This same utility will also convert these files to .DXF format for export to *AutoCAD*. You can save any view as a 2-D drawing simply by using the standard view command to choose top, front, side, rear, or bottom view, then saving it to a file. However, be warned that the program did have some problems importing the 3-D entities in a .DXF test file.

By the time you read this review, a new version of Generic's staple, *Generic CADD Level 5*, should be available. Although it was not released in time to be reviewed for this issue, it promises several advantages over *Generic CADD Level 3*, including improved file handling and a shell command that will allow users to "shell out" to DOS to run, among other things, *Generic 3D Drafting*. Editable and transportable attributes are available in the new version, as is *Generic 3D Drafting*'s "tracking" feature.

Generic 3D Drafting's friendly face makes it a natural for many users, especially those who are already using one of Generic Software's other CAD programs. Though it lacks Boolean operations and surfacing commands, *Generic 3D Drafting*'s excellent tracking feature greatly simplifies 3-D construction, and its hidden line removal and shading functions are highly capable. Even with the extra cost of the 2-D package, it's well worth its asking price. ■



Generic 3D Drafting did an excellent job of removing the hidden lines from our test object and shading its various faces.

FACT FILE

***Generic 3D Drafting*, Version 1.1**
Generic Software Inc., 11911 N. Creek Pkwy. South, Bothell, WA 98011; (800) 228-3601, (206) 487-2233; FAX: (206) 483-6969.
List Price: *Generic 3D Drafting*, $349; *Generic CADD Level 3*, $395; *AutoConvert* (.DXF conversion utility), $99.95.
Requires: 640K RAM (additional RAM—LIM-EMS standard 3.2—recommended), graphics adapter, DOS 2.0 or later. Math coprocessor and mouse or digitizer recommended.
In Short: *Generic 3D Drafting* is a natural choice for those to whom ease of use is paramount. Though it's missing some 3-D modeling features, its tracking capabilities and clean user interface make it an excellent tool for creating true and accurate 3-D models. However, you must export views to *Generic CADD Level 3* for dimensioning and annotation.

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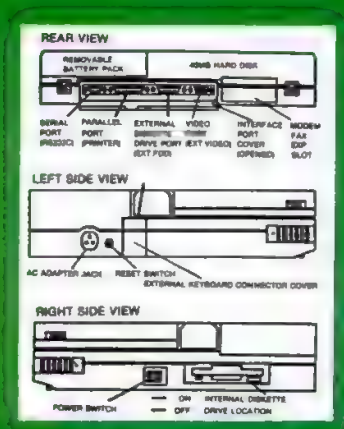

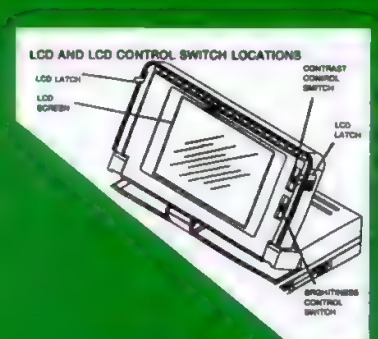

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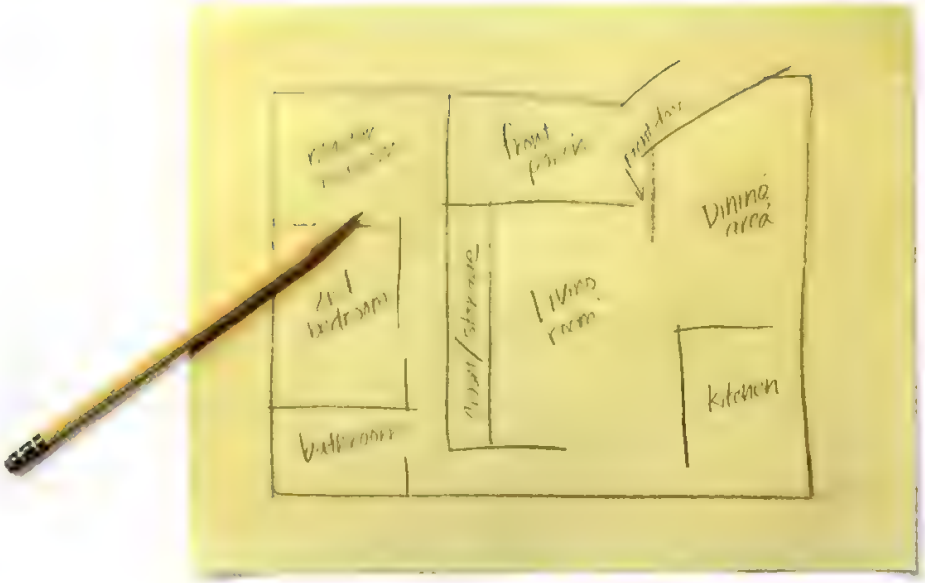

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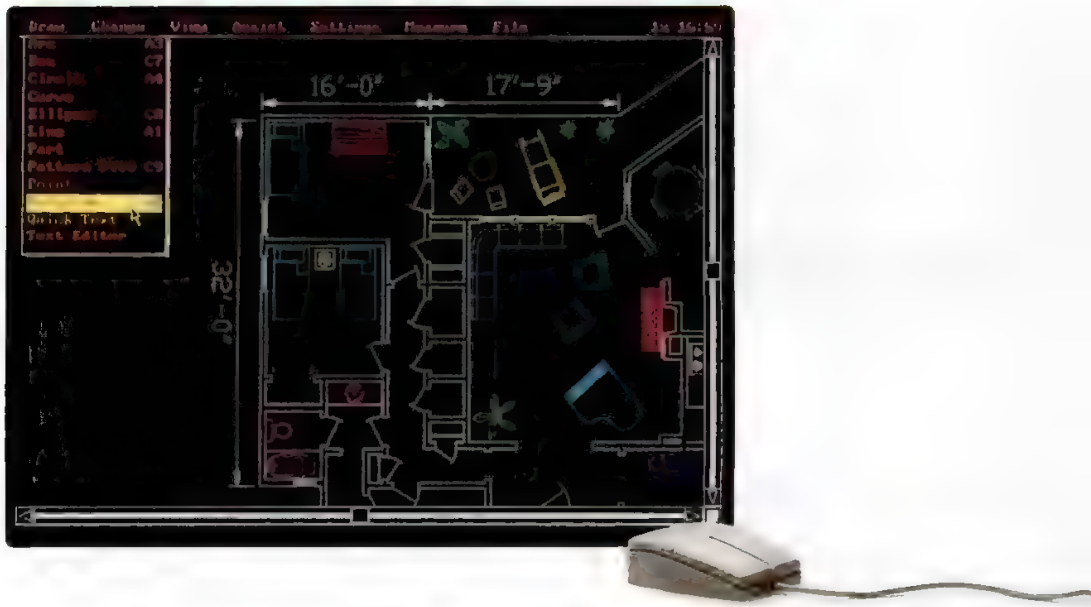

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by
Winn L. Rosch

Lab Notes

An Introduction to Rewritable Optical Disk Technology

The decade-long dominance of the Winchester hard disk is drawing to an end. Such, at least, is the scenario envisioned by manufacturers of rewritable optical disk drives, who foresee laser read/write disks taking over PC storage systems as quickly and decisively as laser-based compact disc systems swept through the stereo industry.

This may be a chilling prospect to some—especially if you're a disk manufacturer heavily committed to Winchester technology, a PC user long accustomed to the capabilities and idiosyncrasies of hard disks, or an economic doomsayer, somberly focused on the balance of trade. Not only is rewritable optical a new technology you'll have to invest in and master, but it's also one in which the United States occupies a technical back seat. While American companies still dominate the Winchester hard disk industry, most of the major players on the optical stage are Japanese.

Yet it's nearly certain you'll have to come to grips with optical data storage eventually. The newly emerging technology has too many advantages to ignore. Rewritable optical disks promise extremely high storage densities—ten times (at least) as many bytes per inch of disk surface as the best of today's Winchester drives. Optical storage is also naturally suited to the use of removable media; that is, to data cartridges that can be stored safely away from the drive or mailed across the country. Moreover, rewritable optical systems are rugged and resistant to many of the plagues of hard disks: Heads don't crash and data doesn't steadily and inevitably deteriorate with time.

Most importantly, rewritable optical storage is no longer an engineer's dream. At least five major manufacturers now offer raw optical disk drives (that is, disk drives without boxes or controllers) that can both write and read personal computer data. Moreover, dozens of system integrators already offer complete package systems that plug into your PC. If you're willing to do a little more head scratching than it takes to connect up a Winchester, and if you can manage the currently monumental investment (at the bottom end, figure $3,995 for an optical drive that provides 300 megabytes of on-line storage), you can add an ISO-standard rewritable optical drive to your system right now.

> ■ No longer the promise of a distant day, rewritable optical disk drives are ready to challenge the tried-and-true Winchester.

Even if buying a rewritable optical drive today would preclude your eating regular meals, you won't be able to ignore the issue for long. Costs are falling precipitously, and the second generation of rewritable optical drives is just around the corner, just about ready to move into your PC, whether that's a desktop or laptop. To help you face the inevitable optical onslaught unruffled and unafraid, this Lab Notes will look at what rewritable optical technology is, where it came from, where it's going, and how you might best use it.

A TALE OF THREE TECHNOLOGIES

As its name implies, a *rewritable optical* storage system is one that uses optical means to read and write disk-based data. It's rewritable because changes made to the disk are reversible—bits can be overwritten nearly as easily as they can with conventional magnetic storage media such as floppies and Winchester hard disks. This reversibility distinguishes rewritable systems from two other current optical technologies, CD-ROM and WORM.

A rewritable, or erasable, CD-ROM is a contradiction in terms. CD-ROM, which stands for compact disk read-only memory, is fundamentally an adaptation of the compact disc digital audio recording system. As with audio CDs, digital data is written onto master disks using special recording equipment that makes microscopic pits in the disk surface. The information encoded in the pits can be read simply by detecting changes in reflectivity: The pits are darker than the shiny silver background of the disk. Because these data pits are a mechanical feature, the disks can be duplicated millions of times by stamping, using pressing equipment similar to that used to produce old-fashioned LP albums. In the stamping process, a two-part master mold is made from an original master disk, and duplicates are stamped by pressing or squeezing a thermoplastic between the halves of the mold. Once a CD-ROM disk is pressed, the data it holds cannot be altered. The pits are present for eternity.

A WORM (write once, read mostly) system can be thought of as a CD-ROM system in which the master writing equipment is contained inside the disk drive itself. As with CD-ROM, a WORM drive stores data by making physical changes on the disk surface. The two technologies differ in that WORM drives usually do not dig a pit, but rather use the heat of the laser to darken the disk surface or evaporate part of it.

For that reason, unlike CD-ROMs, WORM disks cannot be mass-duplicated: The changes in reflectivity on the darkened or evaporated surface cannot easily be reproduced with mechanical stamping equipment. Once written, however, the data on a WORM disk (as well as on a CD-ROM) is there to stay, sealed out of harm's way by a plastic coating.

In contrast to these two irreversible technologies, the data written by rewritable optical drives need not be permanent, but can later be changed and rewritten. At least three technologies have been or are being developed for rewritable optical data storage systems: *dye-polymer, phase-change*, and *magneto-optical*.

The prime example of dye-polymer technology is Tandy Corp.'s highly publicized THOR (Tandy High-performance Optical Recording) system, which has been promoted as a compact disk on which you can record. Dye-polymer systems use transluscent disks that contain a dye-tinted inner layer that swells into a bump when heated by a laser. The bump changes the reflectivity of the disk and can be detected by the same optical system used in a compact disk player. A second laser treatment causes the bump to relax, effectively erasing the encoded data.

While dye-polymer optical drives are not yet available commercially, two companies—Pioneer and Panasonic—now sell phase-change rewritable optical disk drives. Phase-change systems work by creating alterations between crystalline and amorphous states in the recording medium. The two states have different reflectivities, which can be used to encode binary data.

In effect, these state changes are the same media alterations used by some WORM drives. Not surprisingly, the two commercial drives that employ this technology permit the use of both rewritable optical and WORM media. You just slide in the kind of disk you want to use. Unfortunately, that's where the similarity ends: The two commercial products use physically different cartridges to house the disks. The cartridges from one manufacturer cannot be put in a drive from the other. And although each claims a capacity of one gigabyte per 5.25-inch cartridge, the Pioneer unit requires data compression to achieve that value.

Magneto-optical (MO) is the third (and currently the most widely used) rewritable optical method. In this approach, the recording medium in each disk is basically a magnetic material, and magnetic fields are used to store the information. The difference between MO drives and conventional magnetic disk drives is that a tightly focused laser beam supplements the magnetic field used in writing to the MO disk. Further, the laser alone is used to read the disk.

It's literally a technological twist that allows a light beam to read magnetic fields. The laser beam directed at the disk for reading data is *polarized*. That is to say, the oscillations of the photons in the beam are all aligned in one direction. When this polarized beam strikes the magnetically aligned particles of the disk, the magnetic field of the media particles causes the plane of polarization of the light beam to rotate slightly. This phenomenon, illustrated in Figure 1, is called the *Kerr effect*. While small (as little as a 1 percent shift in early MO media, though now reportedly up to 7 percent), this change in polarization can be detected as reliably as the direct magnetic reading used with a Winchester disk.

One important difference separates MO from both phase-change and dye-polymer technologies. The latter two rely on a physical change in the properties of the optical medium to produce the needed changes in reflectivity. By contrast, the magnetic field reversal used by MO drives does not constitute a physical change of state. The magnetic particles never change chemically or spatially.

Materials that undergo real physical changes suffer stress, which can reduce the effective life of the material through fatigue. The metal shell of an airliner, which must expand and contract each time the cabin is pressurized, is a case in point. After too many cycles, the material may become fatigued and fail, potentially giving everyone on board a clear view of the heroic measures of the captain in preventing a disaster. The media used in dye-polymer and in phase-change rewritable optical disks have limited lives because of such fatigue. Magneto-optical media do not.

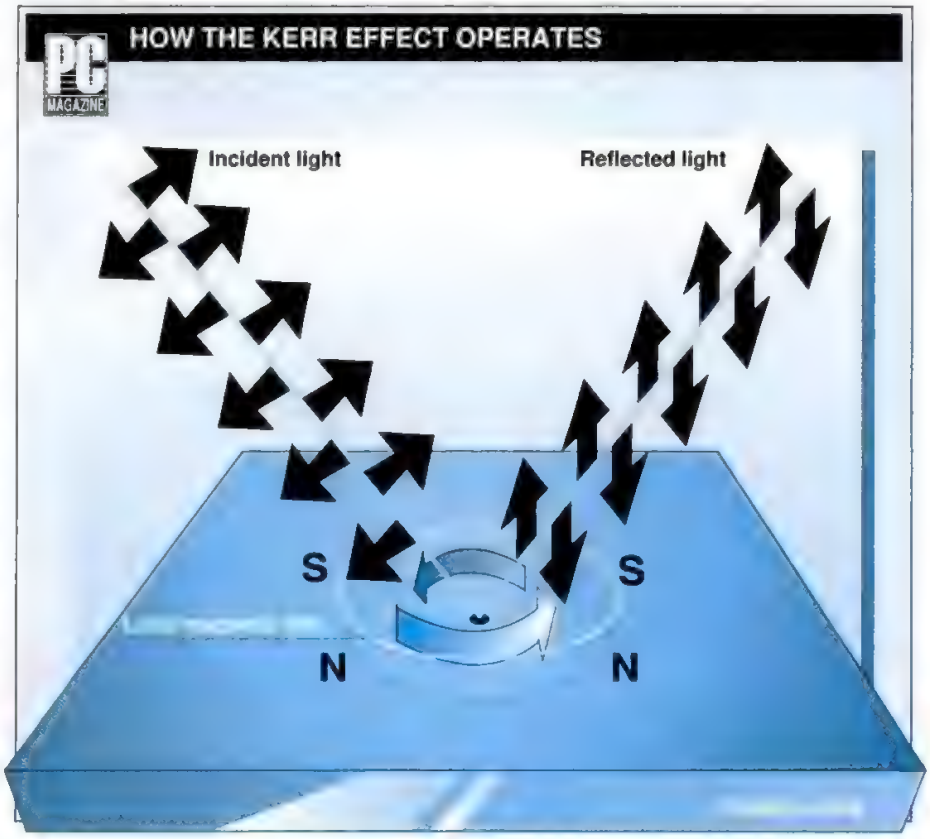

Figure 1: Magneto-optical drives rely on the Kerr effect. When influenced by a magnetic field, the plane of polarization of a light beam is rotated slightly. On a magneto-optical drive, two different magnetic alignments are used to store the two distinct values of a digital signal. Differences in the polarization of the laser beam reflected from the magnetic surface can then easily be detected to retrieve the digital information coded on the magnetic disk surface.

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Whether these fatigue-susceptible technologies can be used successfully for computer storage depends on the application demands and on the number of state changes they can safely endure. Typical phase-change media are rated for lives in excess of 10,000 cycles. While only a few thousand cycles might seem more than sufficient, it is in fact woefully inadequate for conventional PC mass storage applications. Although you may not erase and rewrite the entire contents of your disks very often, DOS busily rewrites the file allocation table on the disk every time you create or add to a file. That may happen thousands of times in a month, a week or even a day. If used like an ordinary magnetic disk, phase-change optical media may quickly fail, with errors occurring first in the most important storage area on the disk, the FAT.

That's not to say phase-change and dye-polymer media are entirely unusable; they're just not amenable to normal DOS operations. Clever engineering can minimize FAT changes, for example, by moving the FAT before it becomes overused. State-change disks can also be effective when buffered by traditional magnetic hard disk media, so that ongoing changes are made to the hard disk and only occasionally spooled off to the optical drive. State-change disks are also suitable for specialized applications that require a limited number of write cycles. A writable digital disk storage system for home audio—the primary purpose of the Tandy THOR system—is a good example. Because most people will record only a few (even a few thousand) times on a given part of a disk, the medium will never be unduly stressed.

Changes in magnetic polarity are well understood and generally believed to be completely reversible. After all, that's how traditional magnetic media—hard disks and floppies—work. Because MO drives are based on this well-understood principle, they are generally considered to be capable of an unlimited number of write-rewrite cycles. There's no worry about stress, fatigue, failure, and data loss.

DOING THE WRITE THING

The long life of MO media would be worthless, of course, were there no way to write data to the disks. And writing to an MO medium poses problems. The only way a laser can alter the magnetic alignment of the medium is physically to blast part of it away. CD-ROM mastering machines and WORM drives use this approach, but it's not acceptable for reusable media.

Nor does writing magnetically offer any hope. A magnetic head used to write data could not pack information any more densely than the information is packed on a conventional Winchester disk. There would be no reason to use the fine probe of a laser beam to read the disk—indeed, no reason for using optical technology at all.

So instead of using optical or magnetic principles alone, MO drives combine them. They use a conventional magnetic field, called the bias field, which spreads over just as large (or larger) an area as is covered by a standard Winchester drive head. But the *coercivity* (resistance to

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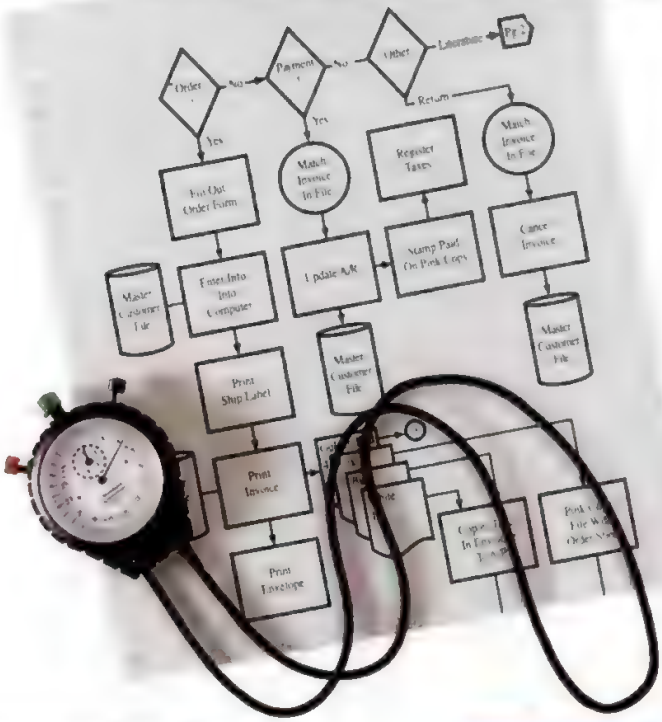

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magnetic changes) of an MO disk is made so high that the bias field alone cannot change that medium's magnetic alignments. When data is to be written, the laser temporarily reduces the coercivity of a minuscule area within the larger magnetic field. Only this area is then affected by the field.

The optical-assist in magnetic recording is possible because of the specific characteristics of the magnetic medium used in MO disks. The basic coercivity of a magneto-optical disk is about an order of magnitude higher than the 600 or so oersteds of the typical Winchester disk. (An oersted is a unit of magnetic intensity, named after 19th-century physicist Hans Christian Oersted.)

This high coercivity gives MO disks one of their biggest advantages over traditional Winchesters, for it makes them virtually immune to self-erasure. All magnetic media tend to self-erase. That's to say, with time, their magnetic fields effectively lose intensity through the combined effects of external and nearby internal magnetic fields upon them. Coercivity represents resistance to changes in magnetic orientation, so the higher the coercivity, the better a medium resists self-erasure.

Thus, MO disks, with their very high coercivities, can maintain data more reliably over a longer period than Winchester disks. The quoted lifetime for MO disks is ten years. That's difficult to prove, because MO drives have not even existed for ten years, but many industry people view even that claimed lifetime as conservative.

Traditional magnetic media require refreshing every few years, to guarantee the integrity of their contents. Mainframe computer data tapes, for example, are typically refreshed every two years. MO media promise to extend the time between refresh cycles substantially, if not eliminate the need for refreshing altogether.

The high coercivity of MO media also makes the disks resistant to the effects of stray magnetic fields. While a refrigerator magnet means death to the data stored on a floppy, it would probably have no effect on an MO disk. (Still, of course, you wouldn't want to clamp your MO disks to your system unit with refrigerator magnets). But superior resistance to stray fields means that you can worry less about where and how you store MO cartridges.

Along with its benefits, however, the very high coercivity of MO media presents one challenge: how to obtain a high enough magnetic flux to change the magnetic orientation of the medium (that is, to erase or write to it) while keeping the size of the recorded magnetic domains small. As mentioned above, temporarily reducing the coercivity is how the laser assists the bias magnet in an MO drive.

The coercivity of any magnetic material decreases as its temperature increases. Coercivity actually becomes zero at a media-dependent value called the Curie temperature. By warming the MO disk medium sufficiently, the necessary field strength to produce a magnetic change on an MO disk can be reduced to a practical level. The magnetic medium used by MO disks is specifically engineered to have a low Curie temperature, about 150 degrees Celsius.

By increasing the power fed to it, the same laser used to read the MO disk can be used to raise the recording medium to or near its Curie temperature. The laser beam is tightly focused to achieve a tiny spot size. Thus, as shown in Figure 2, while the magnetic field acting on the medium covers a wide area, only the spot heated by the laser actually changes its magnetic orientation; only that spot is heated sufficiently to drop its coercivity to a very low value.

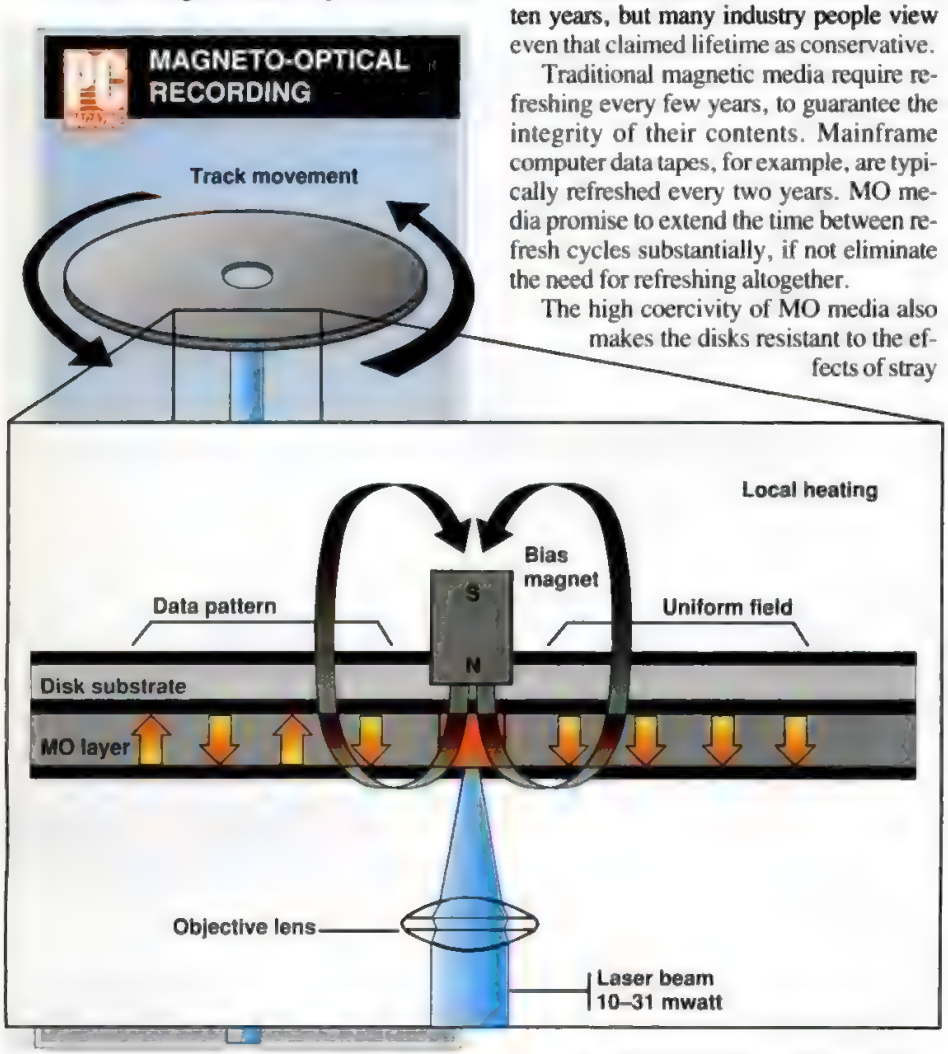

Figure 2: In MO recording, a bias magnet applies a constant magnetic force insufficient by itself to reverse the polarity of the high-coercivity magnetic medium. When data is to be written or erased, a powerful laser beam momentarily heats just the appropriate spots on the magnetic layer so that the bias field becomes sufficient to cause the polarity to change. Here, the laser is erasing the disk by uniformly aligning all the magnetic domains in the MO layer.

ONE-WAY STREET

The design of today's MO drives has one intrinsic drawback: The bias magnetic field must remain oriented in a single direction during the writing process. It cannot change, because the high inductance of the electromagnet that creates the field prevents switching the magnet's polarities rapidly. Because of its low inductance, the head in a conventional hard disk can change its polarity millions of times per second in order to write the two states of digital data. The bias magnet in today's MO drives can align magnetic fields in only one direction at a time. Thus, if the bias field is polarized in the upward direction, the bias magnet can (when aided by the laser's spot heating) change any downward-oriented fields on the disk to an up-

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ward polarity, but it cannot turn upward-oriented fields to the downward direction.

In order to write binary data, the MO recording process requires that all magnetic domains in the area to be written be oriented in a single direction before the data is written. In practice, this means that a given disk area must be separately erased before it can be recorded. In conventional MO drive designs, the erasure process requires a separate pass under the bias magnet with the polarity of the magnet temporarily reversed. After one pass for erasing previously written material, the actual information is written on a second pass.

The penalty imposed by this two-step process is an increase in the average access time of MO drives when writing data. Although speeds vary somewhat, many MO drives spin their disks at a leisurely 2,400 revolutions per minute—roughly a third slower than the 3,600 RPM of typical Winchester disks. Each rotation of an MO disk, therefore, requires 25 milliseconds. Thus, even discounting head movement, the average access time for an MO drive cannot possibly be faster than 37.5 ms. (On average, the data to be erased will be located half a turn—12.5 ms.—away from the read-write head, and a second spin to write the data adds another 25 milliseconds.) Understandably, most manufacturers are working on "one-pass" MO drives and are increasing the RPM of their disk drives.

MO drives impose one further performance penalty. While Winchester read-write heads are typically flyweight mechanisms that weigh but a fraction of a gram, the read/write heads of MO drives are relatively massive assemblies of magnetic and optical parts. Typically, the MO head mounts on a sled that slides on parallel steel tubes. Moving the large head assembly requires a robust mechanism and, thanks to the principle of inertia, it takes substantially longer to speed up, slow down, and settle an MO head assembly than is needed for a Winchester head. In fact, when it comes to average access time, there is almost no comparison to Winchesters, which can now write data as quickly as 15 milliseconds between random bytes, and MO drives, which at their current best are no faster than 60 ms.

The optical sled used by MO drives is not without certain redeeming qualities, however. Unlike the Winchester drive head, which must fly mere microinches (millionths of an inch) above the media surface to pack data tightly on the disk, optical heads can work at a distance. The guide rods for an MO head assembly hold it away from the disk by a distance that is huge compared with that on Winchesters, and with this distance comes safety. Head crashes are impossible on MO drives, because the head is restrained from coming close to the media. Only the laser beam ever touches the disk surface (or should—keep your fingers out of the protective door in the MO cartridge!).

For still further protection, as with CDs, the optically active surface of an MO disk is sealed beneath a tough layer of transparent plastic. The laser beam focuses through the clear covering. Moreover, because the beam is out of focus at the surface of the disk and only converges to a spot underneath the clear surface layer, imperfections such as scratches or dust on the top of the disk have relatively little effect on the accuracy of disk reading or writing. As if all this weren't enough, MO drives also incorporate error-correction to minimize the appearance of errors in the stream of stored data.

> Head crashes are impossible on MO drives, because guide rods hold the head assembly away from the disk and so restrain it from coming close to the media.

ASSORTED SECTORS

Clearly, speed is not a compelling reason to invest in an MO drive. Winchesters will always have a performance advantage over MO products, at least if you believe the predictions made by hard disk manufacturers. But MO drives have their own distinct advantages that make them an excellent choice for many applications.

Although sheer capacity is often cited as one advantage of MO disks, direct comparisons between Winchester and MO capacities are often misleading. The quoted capacities of 5.25-inch disks in both types of drive are in roughly the same ballpark: a maximum of about a gigabyte. But while Winchester drives use up to 15 internal disks or platters to achieve that capacity, the higher data packing density of MO drives allows them to reach the same figure with a single platter.

Misleading fact number one: Although MO drives have capacities in the range 600MB to 1,000MB, only half of that amount is really on-line storage. All of today's MO drives house their storage media in plastic cartridges, and the disks inside have two usable sides. Current MO drives, however, have only a single read/write head, so only one side of a cartridge can be used at a time. To access the other side, you have to remove the cartridge from the drive physically, flip it over, and slide it back in. Consequently, only half of the total capacity of the cartridge is actually on-line at any given time.

Misleading fact number two: While MO drives are usually rated with capacities per cartridge, a single *drive* actually has an unlimited capacity. When you run out of space, you need only slide in a new cartridge. (The price per additional cartridge is currently about $250.) Of course, only about 300MB of that unlimited total can be accessed at a time.

Most makers of MO drives also offer "jukebox" systems, sometimes termed *autochangers*. These units can automatically shift between several disks, to achieve astonishing near-line storage abilities of 50 to 100 gigabytes. It's called *near-line storage* because you do have to wait while the autochanger finds the correct cartridge and spins it up to speed.

Cartridge-based systems also possess another potential strength. Their media can be used for data exchange. Slide an MO cartridge into a Federal Express envelope, and you can move almost a gigabyte across the country for a few dollars.

MEASURING UP

Data exchange depends on standardization. The cartridges written on one machine must be readable by others. In the last year, MO drives have gone far in achieving the necessary standardization, because the International Standards Organization (ISO) has promulgated a set of specifications for 5.25-inch MO car-

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tridges. The ISO standard guarantees that any ISO-standard cartridge can be used in any drive supporting the standard. While that sounds pretty straightforward, it's not quite as simple as it seems.

The ISO standard is actually a dual standard. It allows 5.25-inch MO cartridges of two types: those that store data in 1,024-byte sectors and those that store data in 512-byte sectors. Because larger sectors mean less overhead (among other things, fewer sector-identification markers are required), 1,024-byte-per-sector cartridges can store more data: about 650MB per cartridge (325MB per side), versus about 594MB (often rounded to 600MB) for 512-byte-per-sector cartridges (297MB per side). The actual capacity of each cartridge varies, however, and is inevitably smaller than these figures suggest. That's because, as with hard disks, magneto-optical cartridges may have bad sectors that cannot be used for data storage.

Under the ISO standard, a drive must be able to read and write both types of cartridges. Drives produced before the standard was adopted (or by companies not recognizing the standard) may be limited to one or the other size. One company, Maxtor, produces ISO-capable drives that are also able to store up to 1 gigabyte per cartridge by packing more sectors on the wider, outer tracks of each disk.

But the ISO standard is not the whole answer for it does not guarantee that cartridges written in one MO drive will be readable by another. Although the standard specifies the *physical* format in which data is stored on the disk, it does not dictate the *logical* format. Different system integrators may thus choose their own disk-partitioning schemes, and the software drivers used by one MO system vendor may not recognize the partitioning used by another. Few MO drive integrators have opted to use standard DOS partitioning.

Compatibility is not the only issue affected by partitioning in MO drives. The capacity of an MO cartridge (as well as the disk's formatting and even the number of bytes per sector) has a perhaps-unexpected effect on the data throughput performance of the drive.

A cartridge partitioned for standard 32MB DOS volumes may in fact deliver only half the effective throughput of a drive using a proprietary partitioning scheme that allows the entire capacity of one cartridge side to be addressed as a single volume. This performance effect arises because larger volumes on MO cartridges result in larger DOS storage clusters, and larger clusters reduce the overhead involved in extended data transfers.

The actual performance of MO drives also varies more widely than conventional hard disks, because the ISO standard specifies that MO drives use the small computer system interface (SCSI) to connect to their hosts. While this interface choice has its advantage in flexibility (for example, up to seven SCSI devices can be connected to a single host adapter), SCSI can also be a handicap for DOS users. The performance of SCSI devices in DOS-based computers is severely constrained by the SCSI host adapter used. A good SCSI host adapter will allow an MO drive to transfer data at the speed data can be recovered from the spinning disk, a rate on a par with today's best Winchester hard disks. But a poor SCSI adapter may limit mass storage throughput to 10 percent of its possible peak rate, making the overall system painfully slow. Worse still, SCSI systems do not integrate seamlessly with today's PCs and DOS. Thus, installation can be a headache with many of today's MO systems.

MO drives are particularly suitable when you need a safe, secure means of storing hundreds of megabytes.

One strong point of the ISO standard, however, is that it does strictly define the MO cartridge and the media it contains. Not only does this aspect of the standard assure physical compatibility of cartridges, it also ensures that multiple sources of supply will be available, potentially making media less expensive.

Although they are normally called 5.25-inch disks, most of today's drives use cartridges whose disks have an inner diameter that actually measures 130 millimeters (5.12 inches). The cartridges themselves measure 0.43 by 5.31 by 6.02 inches (HWD) and somewhat resemble 3.5-inch floppy disks in that the disk itself is protected by a sliding metal shutter. Smaller MO disks 3.5 inches in diameter are in the process of being standardized by the ISO.

The magnetic medium on an MO disk is constructed from several layers. First, the plastic substrate of the disk is isolated with a *dielectric coating*—a thin layer of nonconductive material. The actual magneto-optical compound—an alloy of terbium (a rare-earth element), iron, and cobalt—comes next, protected by another dielectric coating. A layer of aluminum atop this provides a reflective surface for the tracking mechanism. This sandwich is then covered by .30 millimeters of transparent plastic. Disks are made single-sided; two are then glued together back-to-back to produce two-sided media.

Unlike conventional Winchester disks, which store data on a number of concentric tracks or cylinders, under the ISO standard MO drives use a single, continuous spiral track—much like the groove on a phonograph record. This optimizes the data transfer of the drive, because the read/write head does not need to be moved between tracks during extended data transfers. Instead, it smoothly scans across the disk under servo control.

The spiral arrangement of data on magneto-optical drives under the ISO standard does lead to a problem in nomenclature. Strictly speaking, an MO disk is like a vinyl phonograph record: it has but two tracks (one on each side). Under the ISO standard, however, the data on the disk is aligned as if the tracks were concentric. To maintain the analogy with conventional hard disks, MO disks are typically described in terms of tracks per inch, with a "track" in this case being the length of the stream of recorded data that passes under the read/write head in one revolution.

MO AT WORK

The spiral tracks of MO cartridges show that the drive designers recognize that the technology is not at its best when randomly accessing data; rather, it favors large, sequential transfers. Consequently, current MO drive systems are not aimed at universally replacing Winchester hard disks as primary mass-storage media. Their role today is described as *secondary mass storage*—an uncharted territory between hard disks and streaming tape.

In other words, MO drives are not yet the optimal choice for every application,

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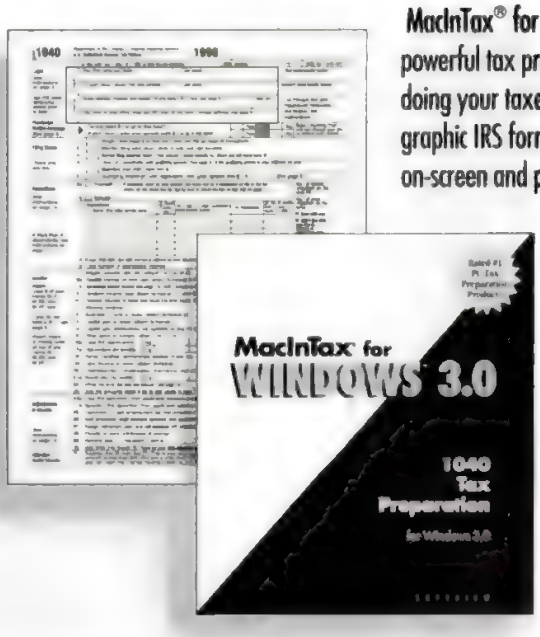

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but they have significant strengths that make them particularly suitable when a safe, secure means of storing hundreds of megabytes is required. Graphics and audiovisual systems are particularly good candidates, because MO cartridges provide the capacity needed for easy exchange of extremely large files. Engineers, for example, can put huge CAD files on MO disks.

MO drives can also be an excellent backup medium, particularly in network applications. A single cartridge can back up all but the largest hard disks. Moreover, the ability to recycle cartridges allows them to fit into traditional backup arrangements, in which backup media are routinely erased and reused after a routine holding period. Compared with tape media, restoration of files from MO disks is fast and easy. Still, MO cartridges are substantially more expensive (by a factor of at least two) than open-reel or cartridge tapes of the same capacity.

MO disks also make an excellent archival medium. Cartridges are compact enough that you can carry several in a briefcase or even lock them securely in a safe. Data stored on them is safe for long-term storage, because (thanks to their high coercivity) MO media are virtually free from self-erasure and highly resistant to external magnetic perils.

In some systems, MO drives could replace hard disks as the primary mass storage system. With suitable caching software, the throughput performance of MO disks can be raised to nearly the level of a conventional hard disk. However, the access time lag will still become apparent during cache misses; that is, when the data the system requires is not already in the cache and must be fetched directly from disk.

Writing the obituary for hard disks is probably premature. Rewritable magneto-optical disks probably won't displace Winchester technology soon. And like most new technologies, MO is apt to achieve its greatest success in a new role, one that it will likely define itself. As of today, MO technology is both useful and available. And it affords possibilities that may soon change the way you use your PC. ■

Winn Rosch is a contributing editor of PC Magazine.

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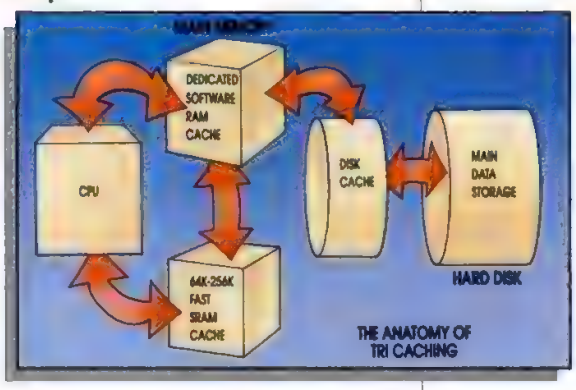

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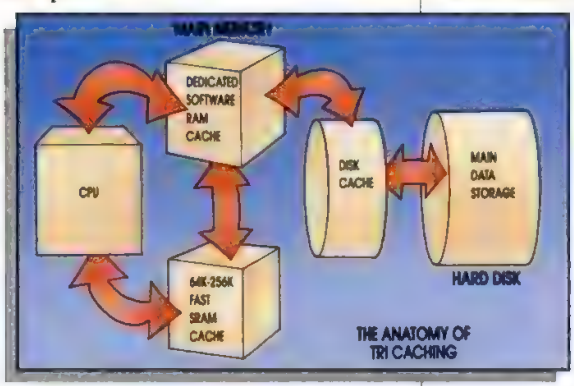

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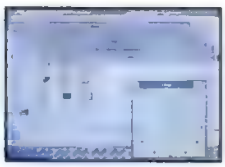

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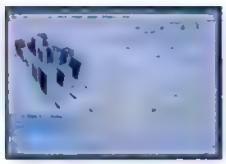

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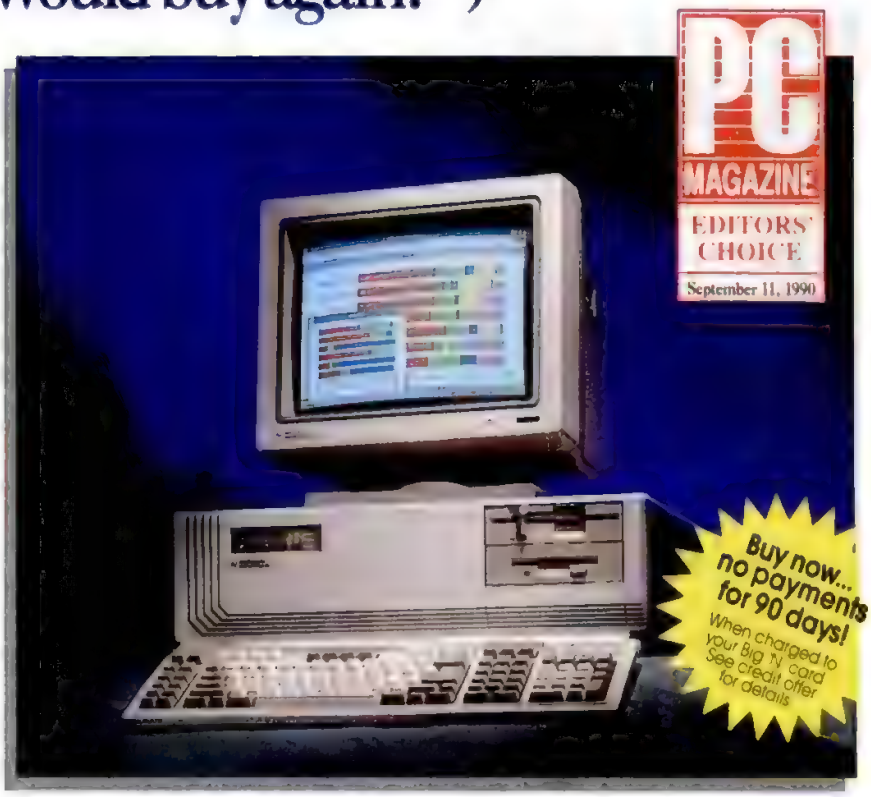

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**PC Magazine*, September 11, 1990 ***PC Magazine*, September 25, 1990
†*InfoWorld*, July 30, 1990 ††*Computer Currents*, August, 1990

Northgate® Elegance™ 386/33 System...

Now! Northgate Slashes Price... Doubles No-Risk Trial To 60 Days!

PC MAGAZINE EDITORS' CHOICE October 31, 1989

INFO WORLD 1989 TOP 100

COMPUTER SHOPPER Best Buy

NOVELL LABS AUTHORIZED TESTED AND APPROVED NetWare Compatible

Award winning 386 performance! Sizzling Northgate Elegance 386/33 and 386/25 systems won *PC Magazine* Editors' Choice awards, were rated #1 and #2 products (respectively) in *InfoWorld* AND received *Computer Shopper* "Best Buy" recognitions. No other company can make that claim! Here's how we did it!

Elegance 386's high performance motherboard is designed and manufactured by Northgate. With a 16Mb 32-bit DRAM capacity, it's consistently rated in the top 1% of performance — at 25 and 33MHz, Elegance 386 is the fastest in its class!

Tri-caching started here! Elegance was Northgate's first triple caching machine. It comes with 64K read write-back SRAM cache to accelerate the execution of instructions. (Northgate exclusive 256K system available.) A 32K hard drive cache controller accelerates I/O transactions while Smartdrive DOS disk caching software increases overall system throughput.

Zip through demanding programs. Multi-stage caching easily handles even a heavy overhead of video programs, I/O intensive tasks, network servers, large data bases and advanced desktop publishing programs.

Desktop or tower. . .your choice! Elegance 386 comes standard in our elegant five bay desktop case. Our popular seven bay tower case is also available. Either way, you get plenty of room for all kinds of I/O boards, and internal/external peripherals.

Start with our monochrome system! Northgate uses a modular approach that lets you add the components you need. Northgate's Elegance 386 mono system includes 4Mb of RAM, a 40Mb fast access hard drive, 1.2Mb 5.25" and 1.44Mb 3.5" floppy drives, a 14" high resolution monochrome monitor and our exclusive *OmniKey*® keyboard.

PC Magazine said: Elegance "combines top performance, good components and aggressive pricing...an excellent performer all around."*

Tell us what you need... we'll build your system! Performance options include: hard drives up to 1.2 gigabytes with 15ms access; VGA and SVGA color cards and monitors; Intel and Weitek math coprocessors; CD ROM and optical drives; tape backups; printers and a host of others!

Industry's finest 24-hour toll-free technical support! Your Elegance 386 is backed by expert technical support any time you need it. Call toll-free, 7 days a week, 24 hours a day. PLUS, free on-site next day service to most locations if we can't solve your problems over the phone.

Elegance 386 is backed by a one year warranty on parts and labor; five years on the *OmniKey* keyboard. If a part fails, we'll ship a replacement to you overnight at our expense — before you return your part!

Now! Use Elegance 386/25 or 33MHz RISK FREE for 60 days! If it fails to meet your expectations, return it. No questions asked.

Elegance 386 Monochrome System Features:

- 25 or 33MHz Intel® 80386DX processor
- 4Mb of 32-bit RAM (expandable to 8Mb on motherboard; total system RAM of 16Mb with optional 32-bit memory card)
- U.S.-made motherboard
- 40Mb fast access hard drive; 16-bit controller with 1:1 interleave; 32K disk read-look-ahead cache buffer
- 64K SRAM memory cache; read/write-back caching
- High density 1.2Mb 5.25" and 1.44Mb 3.5" floppy drives; also read/write low density disks
- Eight expansion slots; one 32-bit slot; six 16-bit and one 8-bit slot
- Weitek math coprocessor support
- One parallel and two serial ports
- Hercules compatible video adapter
- Clock/calendar chip rated at 5 years
- 200 watt power supply (220 watt power supply in tower case
- Desktop case with room for three exposed and 2 internal half-height devices; optional seven bay tower case has room for three exposed and four internal half-height devices
- Front mounted reset and high/low speed controls
- Exclusive Northgate *OmniKey* keyboard
- 14" high resolution monochrome monitor
- Microsoft® Windows™3.0 and mouse
- MS-DOS 4.01 and GW-BASIC software installed
- On-line User's Guide to the system and MS-DOS 4.01
- QA Plus Diagnostic and Utility software
- 1 year warranty on system parts and labor; 5 years on keyboard
- FCC Class B Certified

Select our Elegance 386 SVGA Color System! We took our popular Mono System and added even more power-packed features! You get:

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- 14" SVGA 1024 x 768 color monitor
- 16-bit SVGA adapter with 512K video memory

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*PC Magazine, October 31, 1989

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Northgate® Announces...

SlimLine™ 386™/33

Plus! A new 60-day no-risk trial!

First time ever! Now you can have Northgate Elegance™ power, speed and performance in our popular space-saving SlimLine case! Elegance 386 computers shocked the industry with a #1 and #2 sweep of *InfoWorld's* 1989 best product awards; AND three Editors' Choice awards from *PC Magazine*.

Cache! Cache! Cache! Like our powerful Elegance systems, Slimline 386 features 64K SRAM cache to zip through the execution of instructions. For even more speed, we've added a hard drive cache that makes short work of I/O transactions. To top it off, SlimLine 386 comes with Smartdrive DOS disk caching software that anticipates the information you'll need and brings it into the cache for fast access.

Better features across the board! SlimLine's motherboard is fully integrated, allowing maximum system features in the smallest possible space. There's room for up to 16Mb of 32-bit RAM, one parallel and two serial ports, a built-in floppy disk controller and IDE hard drive controller. Plus an integrated SVGA video with 512K video RAM to speed bus throughput—makes the system faster and more reliable! And there's plenty more room for add-on peripherals—with SlimLine you get five open expansion slots.

Cache System!

SlimLine 386 comes with Intel®'s 386DX 33MHz processor. For faster math-based applications—budgets, forecasts, spreadsheets and databases—it features 80387 coprocessor support for adding floating point unit (FPU) speed enhancements.

All purpose system! SlimLine Cache is the perfect network workstation or stand-alone system for business and home use. It also provides excellent support for advanced desktop publishing and graphics applications.

Or select our SlimLine 386 SVGA Color System – the same great features as the mono system plus:

- 200 Mb hard drive – 15ms access
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More great support! Your new SlimLine 386 Cache also comes with a one year warranty on parts and labor; five years on the *OmniKey* keyboard. And, if a part fails, we'll ship a replacement to you overnight at our expense — before you return your part!

SlimLine 386 Mono System Features:

- 33MHz Intel® 80386DX processor
- 4Mb of 32-bit DRAM (expandable to 16Mb on motherboard)
- Down-scaled, U.S.-made motherboard
- 40Mb fast access hard drive; AT bus interface; 1:1 interleave; 32K look ahead disk caching
- 64K SRAM memory cache; read/write-back caching
- High density 1.2Mb 5.25" and 1.44Mb 3.5" floppy drives; also read/write low density disks
- Five open expansion slots; three full length 16-bit and 2 half length 8-bit
- 25 or 33MHz 80387 or Weitek coprocessor support
- One parallel and two serial ports
- Built-in 16-bit SVGA with up to 1024 x 768 resolution; 512K video memory
- Clock/calendar chip rated at 5 years
- 100 watt power supply
- Small footprint SlimLine case with room for two exposed and 1 internal half-height devices
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- Exclusive Northgate *OmniKey* keyboard
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- Microsoft® Windows™3.0 and mouse
- MS-DOS 4.01 and GW-BASIC software installed
- On-line User's Guide to the system and MS-DOS 4.01
- QA Plus diagnostic and utility software
- Smartdrive caching software
- 1 year warranty on system parts and labor; 5 years on keyboard
- FCC Class B Certified

Now use SlimLine for 60 days—Risk Free! We're sure you'll want to keep your SlimLine Cache—so we won't rush you. Put it to the test in your office or home for a full 60 days. If it doesn't live up to everything we say, return it for a full refund—no questions asked.

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Color monitor shown available as option.

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The secret to SlimLine's space-saving design? A fully integrated motherboard designed and manufactured by Northgate! This design reduces bus load—makes the system faster and more reliable!

Motherboard features include a built-in VGA adapter (with 256K video RAM), one parallel and two serial ports, fully integrated floppy disk controller and IDE hard drive controller. Motherboard integration also makes it easier to install modems and add-on cards.

SlimLine's triple cache boosts performance to zero wait state! You get a built-in 64K memory SRAM cache to accelerate the execution of instructions; PLUS, hard drive caching to accelerate I/O transactions; and disk caching software to speed data to and from the CPU!

SlimLine™ 386SX™ 16 Or With 64K Cache!

Plus! Northgate pumps up trial offer. . . now use SlimLine SX for 60-days RISK-FREE!

Unbeatable service! Your SlimLine 386SX is backed by toll-free technical support, 24 hours-a-day, 7 days-a-week. PLUS, FREE on-site service to most locations for one year if we can't solve your problems over the phone. And if you ever need a replacement part, we'll ship it overnight — at our expense — before you return your part.

***PC Magazine** says:**
". . . Northgate stops at nothing to please its customers."

Of course, you also get Northgate's full-year warranty on parts; five years on the *OmniKey*® keyboard. It's no wonder *PC Magazine* reported: "If you're looking for the subjective winner for customer loyalty, Northgate takes first prize."*

Now use SlimLine for 60-days — Risk Free! It won't take you 60 days to recognize the excellent quality of SlimLine SX. But we don't want to rush you. Take your time putting SlimLine to the test. If you aren't completely satisfied after 60 days, you can return it. Northgate guarantees your satisfaction. Order Today!

SlimLine 386SX VGA Monochrome System Features:

- 16 or 20MHz Intel® 80386SX processor
- 1Mb of 32-bit DRAM (expandable to 8Mb on motherboard — 16Mb using 16-bit memory boards)
- Down-scaled, U.S.-made motherboard
- 40Mb IDE hard drive; AT bus interface; 1:1 interleave; DisCache: 32K look ahead disk caching; 19ms access
- 64K SRAM memory cache; read/write-back caching
- High density 1.2Mb 5.25" and 1.44Mb 3.5" floppy drives; also read/write low density disks
- Five open expansion slots; three full length 16-bit and two half length 8-bit
- 16 or 20MHz 80387SX and Weitek coprocessor support
- One parallel and two serial ports
- Built-in 16-bit SVGA with up to 1024 x 768 resolution; 256K video memory
- Clock/calendar chip rated at 5 years
- 100 watt power supply
- Small footprint SlimLine case with room for two exposed and one internal half-height devices
- Front mounted system reset and high/low speed controls
- Exclusive Northgate *OmniKey* keyboard
- 12" VGA monochrome monitor
- MS-DOS 4.01 and GW-BASIC software installed
- On-line User's Guide to the system and MS-DOS 4.01
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OPEN YOUR CREDIT CARD ACCOUNT BY FILLING OUT THE APPLICATION BELOW.

Please complete all appropriate sections, providing at least two years residence and employment history. If you are self-employed, please be sure to complete section d. **THIS IS NOT A CREDIT AGREEMENT!** One will be sent to you upon authorization of an account. (This Form Must Be Signed To Process Your Order.) All Financed Purchases Are Subject To Credit Approval. **If You Have Any Credit Questions, Please Call For Assistance.** Thank You!

A married person may apply for individual credit. I am applying for (check one box, please):
- ☐ JOINT CREDIT with another person. Complete entire application.
- ☐ INDIVIDUAL CREDIT complete only individual section.
- ☐ INDIVIDUAL CREDIT but rely on income of another. Complete entire application.

*If you are a married Wisconsin applicant, you must provide your spouse's information as indicated, even though your spouse may not be signing the contract.

NOTICE TO WISCONSIN APPLICANTS
You must disclose your marital status:
- married
- unmarried
- legally separated

a. Personal Information

NAME _____ HOME PHONE (____) _____
SOCIAL SECURITY NUMBER _____ DATE OF BIRTH ____/____/____
PRESENT ADDRESS _____ CITY _____ ST _____ ZIP _____
DATE OF RESIDENCE MO. _____ YR. _____ BUY ☐ RENT ☐ OTHER ☐ _____
PREVIOUS ADDRESS _____
EMPLOYER _____ DATE OF EMPLOYMENT MO. _____ YR. _____
MONTHLY GROSS SALARY $ _____ BUSINESS PHONE (____) _____
PREVIOUS EMPLOYER _____ DATES OF EMPLOYMENT _____ TO _____

Income from alimony, child support or separate maintenance payments need not be disclosed if you do not wish to have it considered as basis for repaying the obligation.

ADDITIONAL MONTHLY INCOME $ _____ SOURCE _____

b. Credit Information

PLEASE TELL US IF YOU HAVE: CHECKING ACCOUNT (Y/N) _____ SAVINGS ACCOUNT (Y/N) _____
BANK LOAN (Y/N) _____ HOW MANY? _____ VISA (Y/N) _____ HOW MANY? _____
MASTERCARD (Y/N) _____ HOW MANY? _____ FINANCE COMPANY LOAN (Y/N) _____ HOW MANY? _____
DEPT. STORE CHARGE CARD (Y/N) _____ HOW MANY? _____ CREDIT UNION ACCOUNT (Y/N) _____ HOW MANY? _____
OTHER MAJOR CHARGE CARDS (Y/N) _____ HOW MANY? _____

c. Joint Applicant's Personal Information

JOINT APPLICANT'S NAME _____ HOME PHONE (____) _____
SOCIAL SECURITY NUMBER _____ DATE OF BIRTH ____/____/____
ADDRESS _____ CITY _____ ST _____ ZIP _____
DATE OF RESIDENCE MO. _____ YR. _____
JOINT APPLICANT'S EMPLOYER _____ DATE OF EMPLOYMENT MO. _____ YR. _____
MONTHLY GROSS SALARY $ _____ BUSINESS PHONE (____) _____
NAME AND ADDRESS OF NEAREST RELATIVE NOT LIVING WITH YOU _____
_____ RELATIONSHIP _____

d. Self-Employment Information

BUSINESS NAME _____ BUSINESS PHONE (____) _____
TYPE OF BUSINESS ☐ Proprietorship ☐ Partnership ☐ Corporation IN BUSINESS SINCE _____
YOUR ANNUAL INCOME FROM BUSINESS Gross $ _____ Net $ _____
PERSONAL BANKER'S NAME _____ BANKER'S PHONE (____) _____

e. Customer Authorization

I authorize Northgate Computer Systems or its assignees to investigate credit records and to report my performance hereunder to credit agencies. I hereby certify that the following information is furnished to you for the purpose of obtaining credit and is true and correct of the best of my knowledge and belief. There are costs associated with the use of this credit card. To obtain more information about these costs, call us at 1-800-548-1993 or write to P.O. Box 59080, Minneapolis, MN 55459-0080.

NY—A consumer credit report may be requested in connection with this application or in connection with updates, renewals or extensions of any credit granted as a result of this application. If I subsequently ask for this information, I will be informed whether or not such a report was requested and, if so, the name and address of the agency that furnished the report.

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APPLICANT'S SIGNATURE _____ DATE _____

JOINT APPLICANT'S SIGNATURE _____ DATE _____

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I acknowledge that the obligation described herein is being incurred in the interest of my marriage or family.

BUYER'S SIGNATURE _____ DATE _____

*You must request deferred billing when ordering. Payments will be deferred for three billing cycles after shipment. Interest will accrue during the deferred period at a rate of 1.5% per month (18% APR).
This is not an application. A completed application and agreement must be on file prior to approval for credit.

by
David Gerrold

Utilities

Free Your VGA From CGA Captivity With PRISM.EXE

Surely you'll agree that it's absurd to buy a high-resolution VGA monitor, capable of displaying thousands of attractive colors, and then settle for entering your text in the 16 garish colors of the original CGA card. Yet this is exactly what most users do. Against a black screen, your colored letters look like flashy neon signs, while other backgrounds take you straight down the road into Toon Town. And using a white or light gray background is certainly no more appealing, as it creates about as much eyestrain and user fatigue as staring at a light bulb.

The solution to these color problems is PRISM, a VGA palette editor and loader you can use with either mouse or keyboard. PRISM lets you reassign the 16 DOS attributes to any of the 262,144 different shades the VGA display can produce. With this utility, you can transmute the annoyingly bright DOS colors into quieter hues and gentle pastels, saving the palettes you like in short (51-byte) .PAL files you can load—with PRISM—from the DOS prompt. As you play with the values of each color on your display, you'll quickly discover which colors work well together and which don't. With a little experimentation, not only will the improvement in readability be apparent, but you'll find that programs running on your VGA monitor will be much more attractive and far easier to look at for prolonged periods of time.

You can download a ready-to-run copy of PRISM.EXE, together with a number of sample palettes, from PC MagNet; instructions are given in the sidebar "PRISM by Modem." The program is written in Turbo Pascal and uses additional functions from TurboPower's Object Professional library. The complete source code, together with a programmer's README file are also available and can be downloaded from PC MagNet as well. But all you really need, to take advantage of PRISM, is a system running DOS 3.0 (or later), a VGA display, and at least 256K of free RAM.

■ Here's a utility that allows you to set each of the 16 colors on your Video Graphics Array to any of 262,144 shades.

USING PRISM

The PRISM command syntax is simply

```
PRISM [palette name]
```

If you specify the name of a predefined palette (you don't have to type in the .PAL extension) on the DOS command line when loading PRISM, the colors of the previously active palette will dissolve smoothly into those of the named palette. If you don't specify a palette initially, PRISM will enter its editing mode with whatever color scheme is in effect. Note that PRISM saves the underlying DOS (text mode) screen even if set to display an expanded number of rows and columns. When you exit PRISM, the editing screen will fade out and the previous DOS screen will fade back in, but with the new color palette active.

When the palette-editing screen fades in, the 16 current DOS color attributes appear in squares of color across the top of the screen. The two rows of eight squares each are laid out as shown in Figure 1. As you will see the first time you bring up the PRISM editing screen, in the original CGA display, the color values assigned to

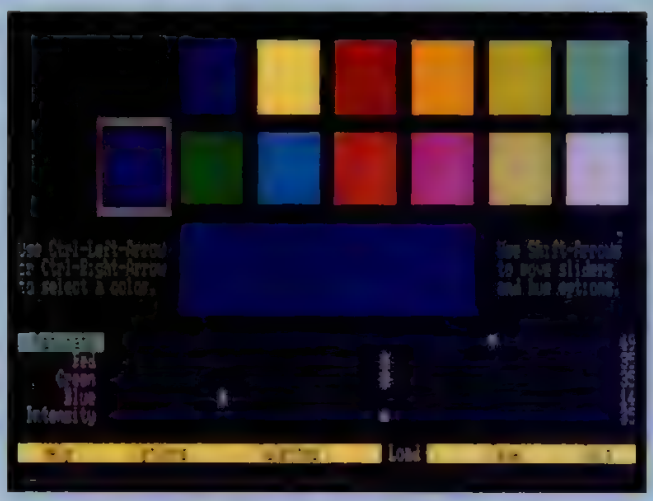

Figure 1: This shows PRISM's palette-editing screen. The squares along the top represent the 16 current DOS color attributes. The larger, rectangular block is the color you are editing using the five slider bars.

the attributes are as follows:

```
0 = black     8 = dark gray
1 = blue      9 = light blue
2 = green    10 = light green
3 = cyan     11 = light cyan
4 = red      12 = light red
5 = magenta  13 = light magenta
6 = brown    14 = yellow
7 = gray     15 = white
```

Below the 16 attribute squares is a larger, rectangular color block. This is the *active color,* the one currently being edited and its corresponding color square above is outlined. On either side of the active color block are a pair of three-line reminder messages.

Below the active color block is a frame of five slider bars. These control the levels of the color values in the active color. The top and bottom sliders control saturation and intensity, which are discussed in more detail in the sidebar "Saturation and Intensity." The interior three sliders control the levels of red, green, and blue in the active color. Mixed in varying proportions, these three primary colors create every color in the VGA spectrum. (The relationship between the CGA, EGA, and VGA colors is discussed in the sidebar "About the Video Graphics Array.") The slider labels are on the left side of the slider frame; on the right side are the numerical values of each slider level.

Below the slider frame is a highlighted menu bar and a help line that provides one-line descriptions of each highlighted menu item. Additional help on each menu item is available by pressing F1, which will pop open a text window containing further information. The PgUp and PgDn keys will move you through the help text.

When the help window is open, an additional press of the F1 key will bring up the help index, which contains several items not otherwise accessible. You can either move the highlighted menu bar to the item on the index you want and press Enter or move the mouse cursor to the index item and click the left mouse button. You can also access the help index at any time, simply by pressing F1 twice. To exit the help window and return to the program, press Esc or click the right mouse button.

USING THE CURSOR KEYS

There are two ways to edit a PRISM palette: with the cursor keys and with the mouse. (If you don't have a mouse installed on your computer, inappropriate options on the submenus will be blanked out.) When editing with the keypad, the important thing to remember is that it has two distinct modes: NumLock ON and NumLock OFF. With the NumLock ON, the keypad is a number pad. With the NumLock OFF, the keypad is a cursor keypad.

PRISM uses the *cursor* keypad for selecting items from the menu and the *number* keypad for editing the VGA palette. You can toggle between menu mode and palette-editing mode by pressing the NumLock key. You can also access the nonactive mode at any time by pressing either Shift key while simultaneously pressing the desired keypad key.

If your keyboard has separate cursor and number keypads, PRISM will respond to the cursor keypad for menu selection and to the number keypad for palette editing. You will have to set NumLock ON.

The PRISM menu works like those of most popular software packages. The Right Arrow cursor key moves the highlighted bar to the right, and the Left Arrow key moves it to the left. You hit Enter to select a menu item. If a submenu appears, the Up Arrow and Down Arrow keys move you up and down on the submenu, and you press Enter to select the appropriate item.

Alternatively, you can select any menu option by pressing the highlighted character in its name. When a submenu is activated, you can select any submenu option by pressing the highlighted character of its name. Thus, for example, you would press H(elp), then K(eypad) to read the help text on editing a palette with the cursor keys. You can cancel any menu operation simply by hitting Esc.

Use Ctrl–Left Arrow or Ctrl–Right Arrow to select a color for editing. The outline box at the top of the screen will move to show the active color, which is simultaneously displayed in the large color rectangle in the center of the screen. You can also press Ctrl-Home to toggle the color selector between the rows of color squares. Note that the Ctrl-shifted keys switch among color squares when you use either the cursor or the number keypad.

Still using the keyboard, after selecting the color attribute to edit, you select the quality to change (saturation, red, green, blue, intensity) with the Up or Down Arrows of the *number* keypad. The selector on the left side of the frame will move to show the currently active slider bar. You then press the *number*-pad Right or Left Arrow to adjust the level of that quality up or down. If the sound effects are on (the default), you will hear a rising or falling musical tone.

Experiment with changing all five qualities of a specific color and you'll easily

SATURATION AND INTENSITY

It's often not enough simply to adjust the primary color components of an attribute; sometimes you need to brighten or darken the color. A color that has been brightened becomes a pastel shade; a color that has been darkened is a muted shade.

To brighten a color, then, you use the Saturation control. When Saturation is at its maximum, that attribute can hold no more color. In effect, it has no white component added to it. As saturation is reduced, more and more color is subtracted and the visual effect is as if more and more white has been added to the color mix.

To darken a color, you use PRISM's Intensity control. Intensity adjusts the level of light with which a color is displayed. As you reduce the level of a color's intensity, it looks as if you are adding a black pigment to it.

To create interesting palettes of colors that work well together, start with one or two strong colors, duplicate them, and then create pastel and muted shades by adjusting Saturation and Intensity. This will give you a palette that can be both striking and pleasing.

To create strong shades of color, move one or two of the primary colors toward maximum. The greater the difference between the maximum and minimum primary colors, the more distinct the attribute will be; the closer together all three primary color values are, the more gray the resultant attribute will be.—**David Gerrold** ■

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understand what each one does. Red, Green, and Blue adjust the level of each primary color component in the currently active attribute. Although Saturation and intensity seem to control the amount of white and black mixed into each shade, their actual functions are just a little bit more subtle and are more fully explained in the "Saturation and Intensity" sidebar.

USING A MOUSE WITH PRISM

If you have a mouse installed on your computer, PRISM will sense its presence and activate the mouse-submenu items. Although you could still use the cursor and number keypads for menu selection and palette editing, you'll almost certainly find it easier to use the mouse.

The behavior of the mouse matches the standard industry conventions. Move the mouse until the mouse cursor is at the desired point on the screen, then click the left mouse button. Clicking the mouse when the cursor is on a "hot spot" triggers the function linked to that screen location, whether it be a menu or submenu option or a quantity on the editing frame. If the mouse is on one of the five lines of the frame, clicking it will move the associated slider to that exact point and the color will be changed accordingly.

You can also "grab" a slider button by moving the mouse cursor atop it and holding the left mouse button down. This allows you to drag the slider along the bar with the mouse, changing the associated value as you go. The effect can range from subtle to striking.

SETTING YOUR DEFAULTS

PRISM has three user-selectable default settings. You can toggle the sound effects on or off, adjust the reaction speed of the mouse, and reset the rate at which one color palette dissolves into the next. These settings are all selected from a submenu that appears when you select the Options item from the main menu. (If you do not have a mouse installed on your computer, the Mouse Speed item on the submenu will be blanked out.) The current state of each of the resettable defaults will be displayed next to the item name, and you can simply cycle through its range of possible values.

The Options submenu differs in one respect from the other PRISM submenus: it does not automatically erase when an item is selected. Choosing an item on the Options submenu changes the state of the item but leaves the submenu displayed. To erase the Options submenu, press Esc or click the right mouse button. Clicking the mouse on another item on the main menu (or selecting it with the cursor keypad Left or Right Arrow keys) will also remove the Options submenu and pop-up the new item's submenu instead.

By default, PRISM provides sound effects to let you know that an action has occurred. Audible key clicks are produced whenever a color is selected for editing and whenever an operation has been selected or concluded. This is why the first mouse-click on a color will produce an audible key-click, but not the second. Clicking on any of the sliders triggers a musical beep, and dragging a slider produces a rising or falling musical tone. Opening or closing a help window also creates a sound effect. If you find the sound effects distracting, you can toggle them off from the Options/Sound Effects menu item.

> If you have a mouse installed on your computer, PRISM will sense its presence and activate the mouse-submenu items.

Some people like a *fast* mouse cursor, one that travels a great distance in response to a very small hand movement. Others prefer a *slower* mouse, which is less responsive to their hand movements so that they can control it more precisely. PRISM lets you set the mouse response rate to any of four speeds: Slow, Normal (the default), Fast, and Zoom! The current setting is always displayed to the right of the Mouse Speed item under the Options menu, and it changes by one step each time you select the option.

One of PRISM's most interesting effects is the way it dissolves from one color palette to another. The dissolve is accomplished by computing the difference between the two palettes and the number of steps it will take to change the values in one palette into the values in the other. Then the values necessary for a single step are added (or subtracted) to the VGA registers. This is repeated for as many steps as it takes to complete the dissolve.

You can change the amount of time it takes to dissolve from one color to another by increasing or decreasing the number of steps displayed. This is set from the Options/Dissolve Rate item, which cycles from 0 to 36, in increments of 6 steps each time the option is selected. The default number of steps is 18, which I find is just about the right speed for a 16-MHz machine using a 386SX processor. Users with slower or faster machines may wish to increase or decrease the dissolve rate.

Increasing the number to 30 or 36 will noticeably slow the rate of the dissolve; however, it will make it smoother. Decreasing it to 12 or 6 will significantly speed up the change. If you would prefer an instant switch between palettes, simply set the number of steps to 0 and the program will pop directly to the new palette every time a change is requested.

Whenever you change any of the PRISM defaults, the new setting becomes active immediately. The PRISM.CFG file will be automatically updated when you exit the program, and the next time you use PRISM, the defaults will reflect the new settings. If there is no PRISM.CFG file, PRISM will create one.

PALETTE MENU OPERATIONS

The Palette item on the main menu accesses five useful palette-editing commands: undo a previous change, swap two colors, restore the original system palette, randomly generate a new palette, and duplicate one color on top of another. Each command can be selected by any of the usual menu operations: clicking with the mouse, pressing Enter, or pressing the highlighted character in the name. Additionally, each Palette command has a shortcut Ctrl-key (displayed with the item on the submenu) that executes the command directly rather than from the menu.

The first item on the Palette submenu is the Undo command. The very ease with which PRISM lets you change colors carries with it the potential for messing up as well as for improving your color display. Thus Undo may be the most important command in the editor.

PRISM actually gives you four different ways to Undo a mistake. You can select P(alette)/U(ndo) from the main menu; you can click the right mouse button; you

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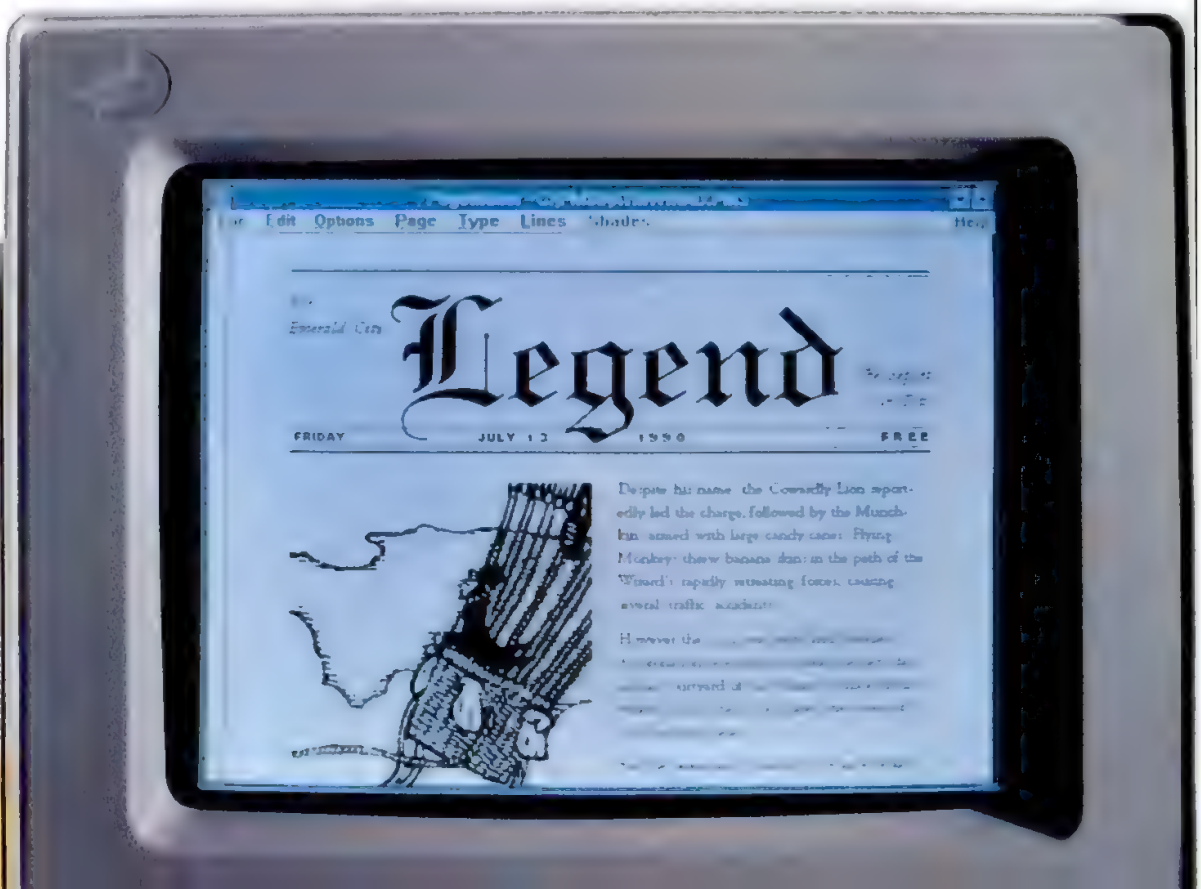

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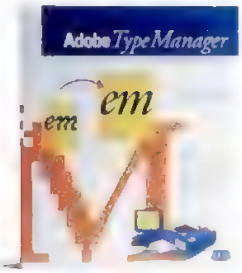

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can press Esc; or you can press Ctrl-U. When you execute the Undo operation, your last color change will be annulled, dissolving smoothly back into the previously active palette. PRISM stores the current palette and the last 15 color changes in an Undo stack memory, so you can successively click your way back through as many as 15 different color changes. When you get to the bottom palette on the stack, PRISM returns to the top, thus letting you cycle through a history of changes and return to your last active palette.

The Undo button is also a cancel button. If there is an operation (such as a color swap) currently pending that you decide not to complete, you can click the right mouse button, press Esc, or hit Ctrl-U to cancel it. The "Operation pending" message will disappear and the screen will resume its normal appearance.

Because DOS accesses its attributes by number, the assignment of a color to a specific attribute number (position) is very important. The second item on the Palette menu lets you assign any color you want to any attribute position simply by swapping it into place. For example, you might want to put an already existing dark blue into position 0 to use it as the background for your palette.

To use the mouse to swap a pair of colors, first click on the color you want to move, making it the currently active color. The outline box will move to that position

ABOUT THE VIDEO GRAPHICS ARRAY

by David Gerrold

The VGA, or Video Graphics Array, has now become the standard display for video graphics for computers running under DOS. A VGA monitor is capable of displaying 262,144 different colors: 16 simultaneously in text mode, and 256 in graphics mode. Unfortunately, however, most DOS text-mode programs still limit you to the original 16 colors of the old CGA (Color Graphics Adapter).

The CGA was the first color display available for DOS-based machines. It could show only 16 colors, and its graphics mode was limited to showing four colors simultaneously at a primitive 200-line resolution. But most MS-DOS programs run in text mode only, so the CGA set a standard for text-mode displays that must be maintained even in the age of the VGA.

The CGA addressed the text-mode screen as 25 lines of 80 columns each. It stored its information in one array of 4,000 bytes arranged in character/attribute pairs. The CGA used a single byte to store the text foreground attribute, the text background attribute, and whether or not the character on-screen was blinking. This allowed 16 foreground colors and 8 background colors. The CGA colors were uniformly bright—even gaudy—and were (and are) often difficult to tolerate for extended work periods.

The CGA was eventually replaced by the EGA (Extended Graphics Adapter). The EGA display put more lines of information on the screen, which produced sharper characters in text mode. It also provided for more colors in graphics mode. The EGA display could generate 256 different colors in its low-resolution graphics mode. And although the EGA was still limited to 16 text-mode colors, those 16 colors could be selected from a palette of 64 possible colors—if your software was capable of addressing the necessary registers.

To achieve its greater color flexibility, the EGA did not store its color attributes in the same manner as the CGA. The CGA stored all its color information in 1 byte. The EGA, on the other hand, used that byte as a pointer to any of 256 different registers, each of which could store a different color value. Unfortunately, only the first 64 of these registers could be used for text-mode colors. *UltraVision* (from Personics Corp.) has used this EGA capability to let you design new color palettes, alter the number of rows and columns displayed on the screen, and change the appearance of the on-screen font. But while the 64 shades available with the EGA represented a significant improvement over the 16 CGA colors, they still fall short of what is possible with the VGA.

The VGA, in its turn, uses the EGA registers as pointers to an even larger array of colors. Graphics mode on the VGA has more lines of video information and can display 256 colors from a palette of 262,144. Text mode remains limited to 16 colors, but these can be selected from a range of 262,144 different shades—again, if you have the right software. The PRISM utility is that right software.

The expansion of possible shades is a result of the way each video card stores a color value. The CGA card used only 4 bits of a byte to hold a specific color value, and so was limited to only 16 separate values. The same byte in the EGA points to a register that stores a color value in 6 bits, allowing 64 different color values. But on a VGA system, the EGA register points to a VGA register that assigns 6 bits to each primary color. This works out to 64 levels of red, 64 levels of green, and 64 levels of blue, which permits a total of 262,144 different color combinations (64 * 64 * 64 = 262,144).

Every color is a combination of different proportions of the three primary colors: red, green, and blue. When each primary color component is at its maximum, the resultant shade is white. When each primary is at its minimum, the result is black. The closer together that all three color values are, the more the resultant shade is muted, as if gray had been added.

While in text mode you are still limited to 16 attributes, by using PRISM, you can assign those attributes to any shade you desire. PRISM lets you "mix" your own palette.

You will quickly discover that muting DOS's gaudy colors makes for a much more attractive and readable display. PRISM lets you design specific palettes for specific programs, giving you one more way to personalize your electronic workspace. And apart from the fun you'll have experimenting with it, PRISM should also help increase your productivity by reducing the user fatigue caused by staring at DOS's garish color scheme. ■

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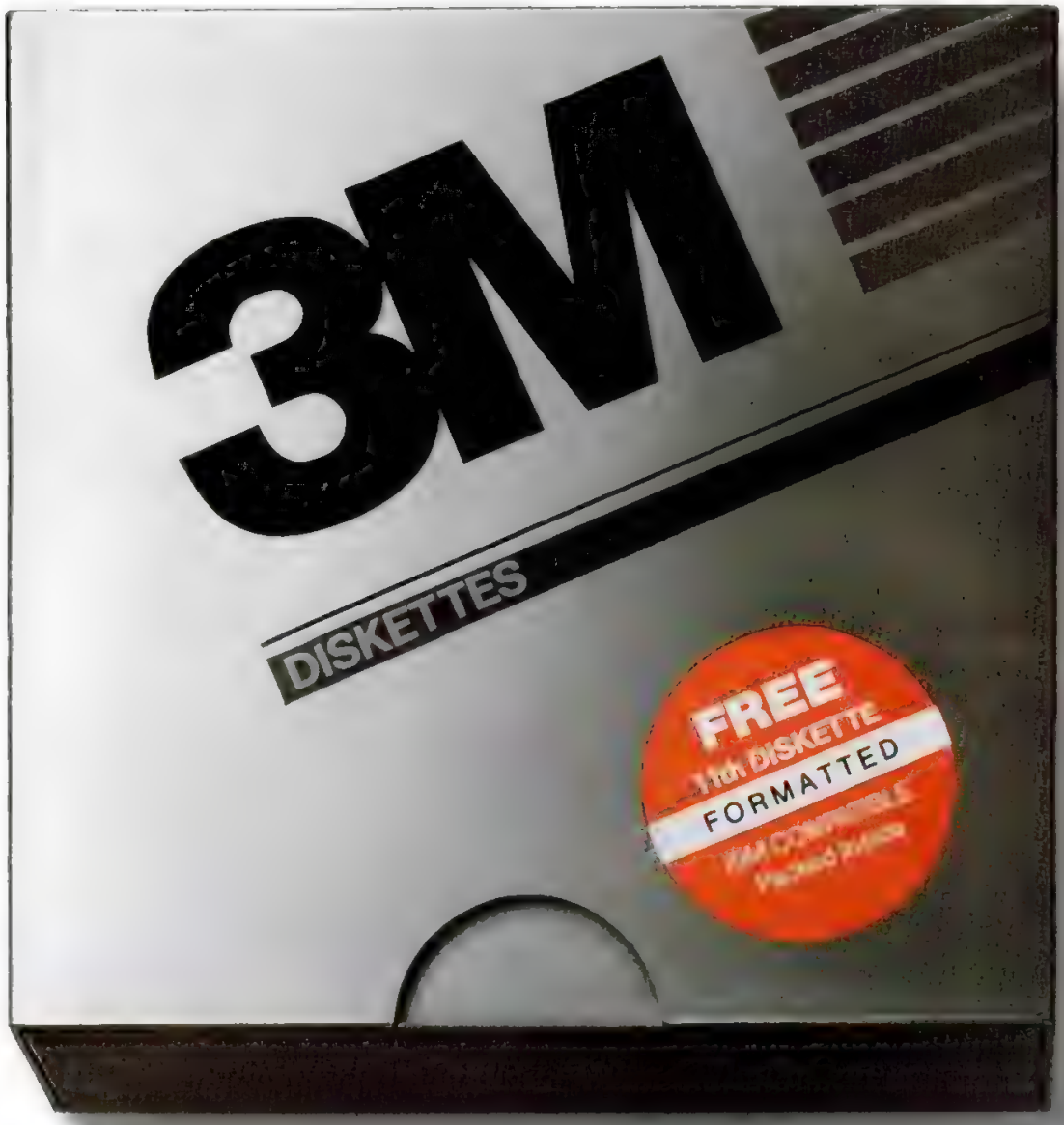

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PRISM Command

David Gerrold — December 11, 1990 (Utilities)

Purpose: A VGA palette editor/loader that enables text-mode display from a palette of 262,144 colors by any of the 16 DOS attribute numbers.

Format: `PRISM [palette name]`

Remarks: If the optional *palette name* (a .PAL file) is supplied when loading PRISM, the original DOS color values will dissolve into those stored in the named palette. Loaded without a *palette name*, PRISM comes up in editing mode, with the 16 current colors arrayed in two rows of squares in DOS attribute order (0 to 7 and 8 to 15). The color currently selected for editing, duplicating, or swapping from one attribute position to another is also shown in a large central rectangle, below which is a frame that separately displays its component saturation, intensity, red, green, and blue values. Colors may be selected by clicking with a mouse (left button), which can also be used to drag the sliders that control the color values. A selected color may be swapped by clicking the mouse on the central box and then clicking on the target attribute position. Duplicating a color is similar, except that the mouse cursor is dragged from the central box to the new position.

Ctrl-R resets the color palette to its entry condition, and Ctrl-U (or Esc or the right mouse button) undoes up to 15 color changes successively. Ctrl–Left Arrow and Ctrl–Right Arrow can be used in lieu of a mouse to select colors, which can be edited with the numeric keypad (NumLock ON) arrow keys. With NumLock OFF, the Arrow keys move between items on the menu bar, from which PRISM commands can also be executed. Palettes can be saved and loaded from the menu bar in edit mode. (The .PAL extension need not be typed for either operation.) Default settings for mouse speed, sound effects on/off, and the dissolve rate between palette shifts can be changed with menu options. F1 accesses an extensive on-screen help system. To prevent accidental exit, the menu Quit command requires two keystrokes or mouse clicks.

PRISM saves and restores the underlying DOS screen even if an expanded number of rows and columns is being used. It will also automatically detect its home subdirectory. PRISM is compatible with *UltraVision*, but will not operate under *Microsoft Windows* or *DESQview*. In addition to a VGA, PRISM requires DOS 3.0 or later and 256K of RAM.

and the large color block will change to that color. Now move the cursor onto the large (rectangular) color block and click again. Two "Operation pending" messages will appear, one on the left side of the block and one on the right. Move the cursor to the target attribute position for the active color and click on it. The two colors will change places on the attribute display and the "Operation pending" messages will disappear. If you make a mistake in your targeting, simply execute the Undo command (Ctrl-U) and you'll be back where you started.

To swap a color pair from the keyboard, you must first select the color to be moved with the Ctrl–Left Arrow or Ctrl–Right Arrow keys. Then activate the Palette/Swap command from the main menu (or by pressing Ctrl-S). The "Operation pending" messages will again appear. Now move the outline box to the target position with the Ctrl-Arrow keys. If you now *reexecute* the Palette/Swap command (Ctrl-S), the interchange will be made and the screen will return to normal.

Sometimes, however, undoing one change—or even the last 15 changes!—is not enough. Sometimes you've gotten so far from where you started that you're hopelessly lost and your system's color display has become totally unreadable. That's what the third item on the Palette menu is for.

When PRISM begins operation, the first thing it does is store a copy of the color palette currently active on your system. You can reset to this palette at any point in your editing session by executing the Restore command, which can be activated in three different ways: by selecting the Palette/Restore command from the main menu; by pressing Ctrl-R (the shortcut key); or by clicking both mouse buttons simultaneously. Note, however, that if you *exit* PRISM without restoring the original palette, the palette active on the editing screen will remain in effect when you return to the DOS command line. This new palette will thus become the "currently active" palette when you bring PRISM up again. If you want to get back, then, be sure to restore before exiting, or save your original palette as a named .PAL file, as explained below.

PRISM's fourth Palette menu command generates New color palettes by poking random numbers between 0 and 63 into a set of attribute positions. Generally, most of these random palettes will look pretty awful: good color combinations rarely happen by accident. Occasionally, however, PRISM will come up with a palette combination that can be edited or adjusted into something pleasing. Moreover, if nothing else, the random palettes can give you some idea of the range of colors possible on the VGA screen.

There are three ways to create a random palette: you can select the Palette/New command from the main menu; you can press Ctrl-N, the shortcut key; or you can double-click the left mouse button on the currently active attribute box. Note that PRISM interprets two clicks as a double-click if they occur within one-third of a second.

When designing or editing a color palette, you'll often find it useful to copy a color into a second attribute slot and then alter its Saturation or Intensity value to create a lighter or darker shade of the same basic color. This is one of the best ways to design a pleasing combination of related shades. Duplicate—the final command on the Palette menu—lets you replicate any color in any position.

Duplicating a color is very similar to swapping a color. If you're using the mouse, first click on the color you want to copy. As before, the outline box will move to that color and the rectangular, currently active attribute box will change to show that color.

Move the cursor onto the large attribute box, but this time instead of clicking on it (as you do for swapping), *hold down* the left mouse button and *drag* the cursor to the target square before releasing it. Note that only the cursor, not the box, will actually move during the drag operation, but while the mouse button is held down the "Operation pending" message will indicate that a duplication, not a swap, is pending. When you now release the mouse cursor atop the target square, you'll find that you've duplicated the source color at the target position. You can then edit the copy to make it darker or lighter or to alter the relative levels of its primary color components. Note that the Undo command works here, too.

Using the keyboard to duplicate a color is again similar to the swap procedure. Use the Ctrl–Left Arrow or Ctrl–Right Arrow key to move the outline box to the color you want to duplicate. Then select the Palette/Duplicate command from the menu or hit Ctrl-D, which will produce the same result. The outline box will change color and the "Operation pending" messages will flash to show you that a duplication is pending.

Now use the Ctrl–Left Arrow or Ctrl–Right Arrow again to move the outline box to the target color square, and select the Palette/Duplicate command (or Ctrl-D) a second time. The color of the first square will be instantly mapped onto the second square, and the editor will be ready for your next operation.

PC UTILITIES UPGRADES

Like all good software, the programs presented in *PC Magazine* are upgraded and improved. The only way to obtain the modified versions is to download them from PC MagNet. Here is a partial list of the programs that have been upgraded to fix minor bugs and system incompatibilities:

ANSI.COM, Version 1.3
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CARDFILE.COM, Version 1.1
CHKFRAG.EXE, Version 1.2
DIRMATCH.COM, Version 1.1
EMS40.SYS, Version 1.1
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LOG.COM, Version 1.1
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For a complete list of all the programs available from the PC MagNet Utilities Database, download the UDCAT .ARC file.

A downloadable index to *PC Magazine*'s product reviews is also available. PCM.EXE is a self-extracting file that contains the *Computer Library PC Magazine* Reviews Index for January 1988 to June 1990. It requires the search files in PCSRCH.EXE. Please read the information file PCM.INF before you download any of these files. ■

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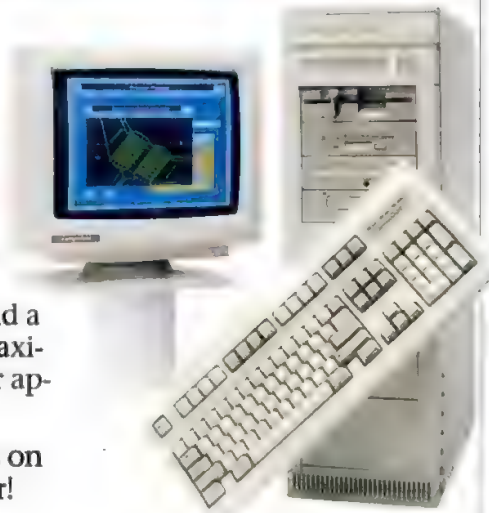

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LOADING AND SAVING PALETTES TO DISK

After designing the perfect VGA color display, you'll naturally want to save it to disk so that you can use it again later. Simply select the Save option from the main menu, by clicking on it with the mouse or by moving the menu bar with the cursor keys and pressing Enter. Even more simply, just press S.

If you have previously loaded or saved a palette, PRISM will open a dialog box to ask whether you want to save your current palette under the name stored in its PRISM.CFG file. If you enter N(o), you'll be prompted for a new name. (You need not enter the .PAL extension; PRISM will supply that.) If you enter Y(es), PRISM will look to see whether the file is still on your disk. If it is, or if the "new" name you select is already being used, you'll be asked whether you want to overwrite the existing file, thus protecting your previous work.

PRISM can load but cannot overwrite read-only .PAL files. For full protection, therefore, you can lock a valuable palette file by making it read-only; check your DOS manual or use a utility such as Charles Petzold's ATTR.COM (*PC Magazine*, June 10, 1986).

PRISM will not accept filenames that designate active devices. You cannot save a palette to a file named CON or AUX or NUL or any other name currently in use as a device driver. Note also that any attempt to write a palette file to a device instead of to a disk file produces no useful result and may possibly hang up your machine.

Sometimes you may wish to see how a palette looks on your system before you save it. You can exit PRISM, leaving the new palette active, and run your program to see what it looks like. If you like the result, bring PRISM up again and select the S(ave) option as you normally would. PRISM always boots up displaying the palette currently active on the system, so you can save that palette for future use if you have not already done so. When you do save the file, PRISM will post a confirmation message, and the next time you select PRISM's Load option, the palette you have saved will appear in PRISM's pick-list window.

As indicated previously, PRISM can load the contents of a named .PAL file directly into the VGA registers, when the program itself is executed at the DOS command line. In this event PRISM's editing mode is simply bypassed.

To load a palette for editing, simply bring up PRISM without specifying a filename and select the L(oad) option from the main menu, using either the mouse or the cursor keys. A pick-list window will appear that shows all your currently available PRISM palette files. You can highlight one of these with either the mouse or the cursor keys; a second click of the mouse or pressing Enter will then load it and close the window.

> If you want to see how a palette looks on your system before you save it, you can exit PRISM, leave the new palette active, and run your program.

Another way to load a palette is by starting to type in its name. I say "starting to type" advisedly, for PRISM uses a smart pick list. As you type the letters of the palette name, the highlight bar will go instantly to the first name on the list that matches what you type. (Alternatively, you can hit the first letter of the name repeatedly and the highlight bar will cycle through all palette names that begin with that letter.) When the highlight bar is on the palette you wish to load, press Enter. The pick-list window will vanish and PRISM will dissolve the currently active palette into the new palette you have selected.

If you decide not to load a new palette after all, you can abort the load operation from the pick-list window by pressing Esc or clicking the right mouse button. The pick-list window will erase itself from the screen without loading a new palette and return you to PRISM's editing mode.

EXITING PRISM

As a safety precaution, PRISM requires two separate keystrokes (or two mouse clicks) to exit. You must select Q(uit)/Y(es) on the main menu to return to DOS. If you accidentally select Q(uit), you can abort the operation by pressing Esc, clicking the right mouse button, or by selecting the N(o) option on the submenu. Note that if you're normally running DOS in other than 25-line text mode, PRISM will restore you to that mode, and when you exit, the last palette active on the screen will be the new active palette for DOS.

COMPATIBILITY ISSUES

PRISM is smart enough to find itself on your hard disk, no matter where you store it. You can put PRISM in a subdirectory with the rest of your utilities or you can ensconce it, together with its .PAL files, in its own subdirectory. In the latter case you won't have to list the subdirectory on the DOS path if you simply create the following batch file as P.BAT:

```
@ECHO OFF
d:\Prism subdirectory name\PRISM
%1
ECHO
```

The *d*:, of course, stands for the appropriate drive letter. Now store P.BAT in a subdirectory that *is* listed in the DOS path and you'll be able to run PRISM from any directory or subdirectory of your hard disk simply by entering

```
P [palette name]
```

and pressing Enter.

The reason this works is that DOS 3.*x* (and higher) stores the full pathname of the current program in that program's environment and thereby allows a program to locate itself, no matter where it is. PRISM uses this information to read and write its configuration file and palette files to the same subdirectory in which the program itself is stored. PRISM doesn't care which subdirectory is currently active; it only reads and writes to its home subdirectory.

Most of us are used to programs that look first in the current directory for files they need and accept a full pathname for a file. If you attempt to load a palette in the current directory, you'll either fail (if a palette with that name doesn't exist in the PRISM directory) or load the file of the same name from the PRISM directory. If you attempt to give PRISM a full path, it will truncate it to 12 characters and, of course, not find the file.

You may wish to create distinctly different color sets for the various applications that you use on your computer. The

best way to do this is to write individual batch files to load the PRISM palette and then the application. For example, to use PRISM with *Quattro Pro*, you might create the following QP.BAT file:

```
CALL P QUATTRO.PAL
C:\QPRO\Q %1
CALL P DOS.PAL
```

This batch file will load the palette you have designed for use with *Quattro Pro*, then load *Quattro Pro* with any spreadsheet filename you enter on the command line with QP. The program will run normally, but with a more attractively colored display. And when you exit *Quattro*, QP.BAT will automatically reload the palette you have designed for use with the DOS command line.

One important caveat, however, is that PRISM cannot maintain its palette during mode changes. While most people are primarily familiar with DOS in its text mode of display, your computer actually has more than one mode for displaying images. Text mode is a display of 80 columns by 25 rows, and displays characters only. Depending on the video display board and the monitor, graphics mode can display anywhere from 200 to 1,268 lines of video information. In graphics mode, the DOS screen generates images (diagrams, icons, and images) a point at a time and uses a different method of assigning colors. When in text mode, DOS generates its screens a character at a time and uses the CGA standard for assigning colors. Whenever you change from one display mode to another, DOS resets all video registers to their default condition and any changes you have made in the VGA attribute registers will be lost. To return to text mode from graphics mode, enter MODE CO80 and then enter the PRISM command to reload the palette you wish to restore.

PRISM is *UltraVision*-compatible. *UltraVision* is an EGA/VGA enhancement utility that lets you reset the number of rows and columns visible in your text mode display, change the display font, and sharpen the display by putting more lines of video information on the screen. Also, *UltraVision* lets you reset your 16 DOS attributes to any color you choose, selected from the EGA palette of 64 shades. PRISM supersedes this latter function.

To make use of *UltraVision*'s other functions, however, simply load that program first, before loading your desired PRISM palette. PRISM will then use the EGA registers that *UltraVision* has selected as pointers to the VGA registers. If you run *UltraVision* after you have used PRISM to load a palette, you will lose your PRISM palette. *UltraVision* will reset the EGA/VGA registers.

PRISM will *not* run under *Windows* or *DESQview*. These multitasking environments attempt to maintain graphics and color integrity across multiple windows. As a result, they will definitely conflict with PRISM, which is a *text mode only* utility. Within that restriction, however, PRISM opens up the VGA color spectrum you've paid for but rarely seen. ■

David Gerrold is a contributing editor for PC-Techniques magazine, in which he has a regular column called "Another Manner." He also writes science fiction novels and teaches screenwriting at Pepperdine University.

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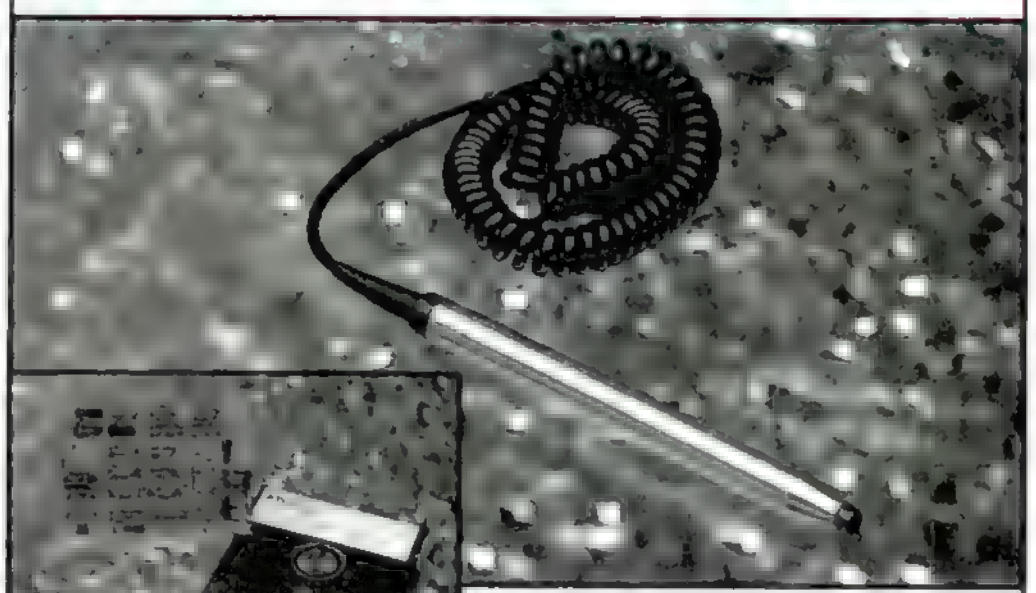

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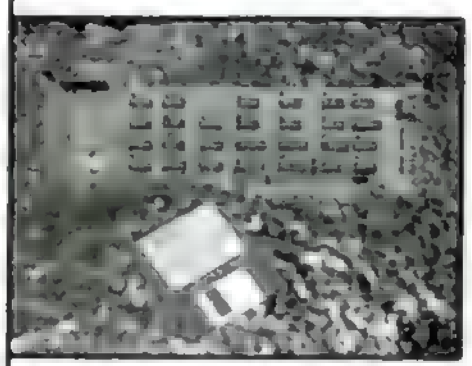

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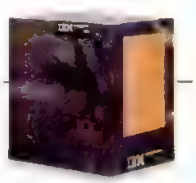

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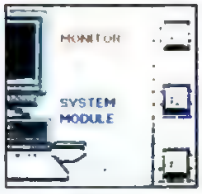

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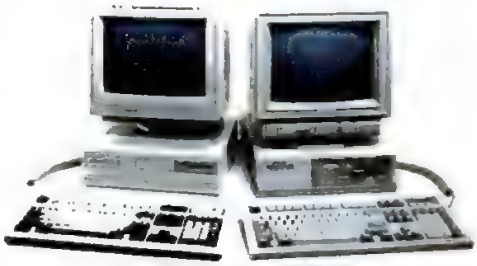

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by
Charles Petzold

Environments

An Introduction to Rendering Color on Video Displays

The human eye is sensitive to electromagnetic radiation with wavelengths ranging from 400 to 700 nanometers (nm). This is known as the visual spectrum of light. The different wavelengths of visible light affect our eyes in different ways, which we interpret as color.

Light from the sun includes radiation from the entire range of 400 to 700 nm in approximately equal amounts. We call this white light. Passing the light through a prism allows us to see the various colors of light within this range. These are the colors of the rainbow, traditionally labeled as red (at 700 nm), orange, yellow, green, blue, indigo, and violet (at 400 nm).

Color is vitally important to our interpretation of visual information. Hence, if we wish to extend the use of the computer into rendering visual information on a video display or other output device through the use of computer graphics, we must have a firm grasp of color.

> ■ Color is vitally important to our interpretation of visual information. But in order to work with color on computers, we need to find a way to quantify it, first.

In the next several Environments columns, I'll discuss color, and more specifically, how it is handled in the OS/2 Graphics Programming Interface (GPI). We'll also explore the new palette manager found in OS/2 2.0.

In this issue, I'll examine different ways of quantifying color, and also some of the common color video display hardware available for IBM-compatible personal computers.

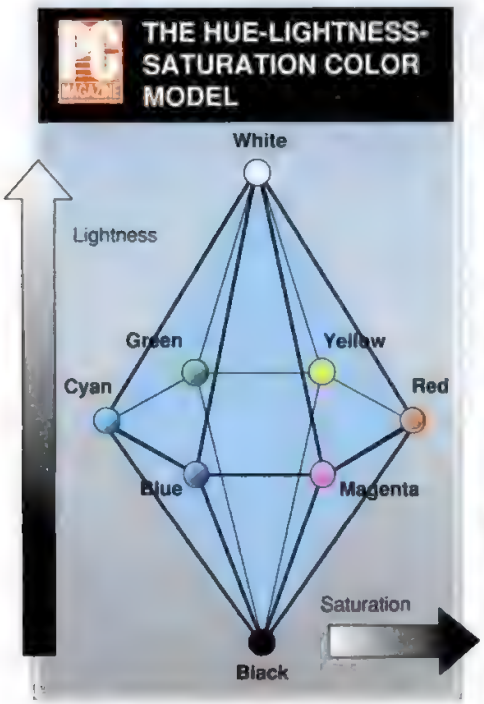

Figure 1: This is the Hue-Lightness-Saturation (HLS) double-hexcone color model. Note that the hues form a circle of color around the middle.

REPRESENTATIONS OF COLOR

Computers deal with numbers, so in order to work with color on computers, first we need to find some way to quantify it. This involves both giving the user of a computer program a way to select a color and allowing the program some way to specify the color when rendering it on an output device.

There are several different ways to do this, and they're all somewhat difficult to visualize, because they involve three parameters. Consequently, trying to represent the entire range of color on a two-dimensional surface is rather awkward.

Two approaches to selecting color that users of a computer program usually find most natural are called the *Hue-Lightness-Saturation* (HLS) model and the *Hue-Saturation-Value* (HSV) model. These two models are closely related—the lightness parameter of HLS is equivalent to the value parameter of HSV.

The HLS model is used in the OS/2 Control Panel program for selecting system colors. The user selects a color by moving three scrollbars. In the Control Panel, the scrollbars are labeled *Color*, *Shade*, and *Amount*, which correspond respectively with *Hue*, *Lightness*, and *Saturation* in the HLS model.

The HLS model is generally visualized as a double-hexcone, as shown in Figure 1.

The *hue* is the dominant wavelength of the light. The range of hues can be derived from the colors of the rainbow, since each of the colors corresponds to a particular wavelength. In doing this, normally the colors are relabeled somewhat, with some parts of the spectrum compressed and other parts stretched out to yield the following:

```
Red
Yellow
Green
Cyan
Blue
Magenta
Red
```

You'll note that I've added red to the bottom, indicating that these hues really

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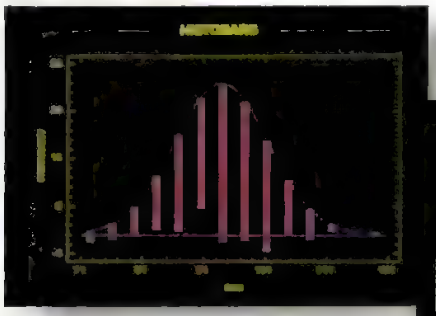

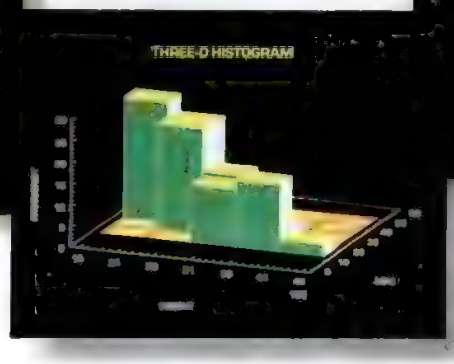

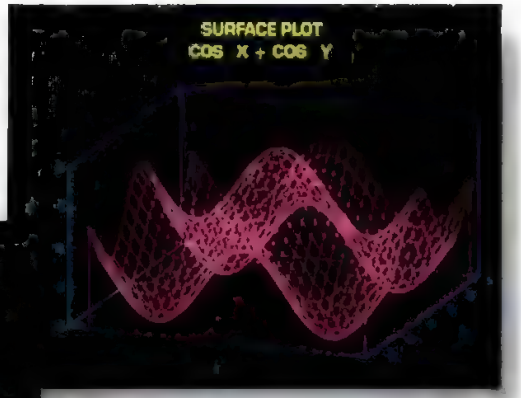

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form a circle of color rather than a straight line, as shown at the middle of the diagram in Figure 1. Generally, the hues are represented by angles, beginning with red at zero degrees and moving around the circle in a counterclockwise direction.

The *saturation* parameter reflects the purity of the color. At its minimum value of zero, the color is a shade of gray, indicating that the color combines wavelengths along the entire visual spectrum. The vertical line in Figure 1 represents the *lightness* parameter. A lightness value of zero yields black and a maximum lightness value yields white, with all the shades of gray ranged in between.

RGB AND CMY

When rendering color on a graphics output device such as a video display or a color printer, two more color models become useful. These two color models are each based on three primary colors, but their primary colors are different.

The additive primary colors are red, green, and blue. These additive primaries are used with graphics output devices that render color using a light source, such as a video display. All possible colors that a video display can render are composed of various combinations of red, green, and blue. (We'll see shortly that this is exactly how video displays work.)

The Red-Green-Blue (RGB) color model is generally pictured as a three-dimensional coordinate system or a cube, as shown in Figure 2.

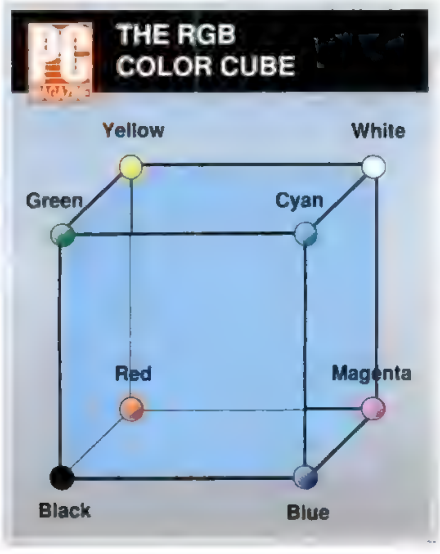

Figure 2: The Red-Green-Blue (RGB) color model is generally pictured as a three-dimensional coordinate system or a cube.

Black is at the lower-left-forward corner. This is the origin of a three-dimensional coordinate space. Increasing values of blue are to the right, increasing values of green are toward the top, and increasing values of red are toward the back.

The combination of blue and green is cyan, the combination of blue and red is magenta, and the combination of red and green is yellow. These three additional colors are at three other corners of the cube. The upper-right-back corner is the combination of red, green, and blue, or white. The interior diagonal from the black corner to the white corner represents all the shades of gray.

When rendering color on white paper, a different color model is required. The paper reflects white light, so the inks on

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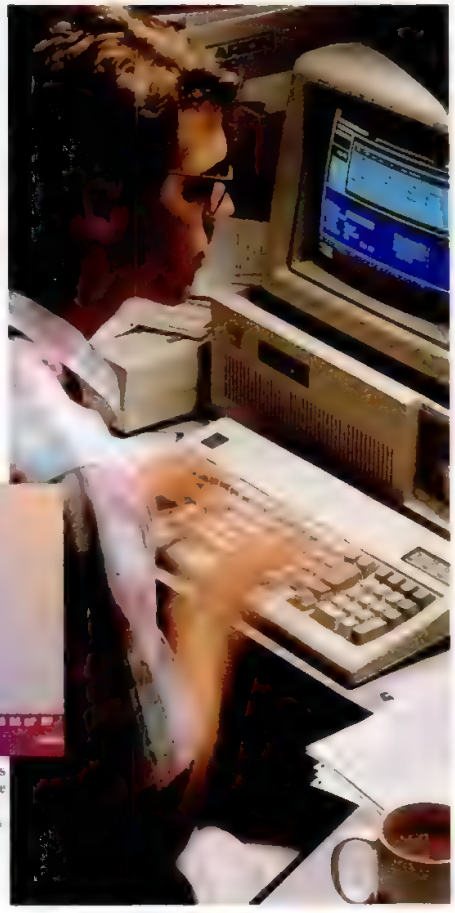

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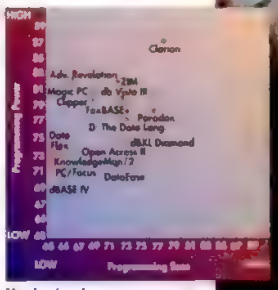

Here's what American corporations in a PC Week survey thought of the power and ease of use of Professional Developer vs. competitors

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the paper must subtract various colors of light from the white light. The colors that do this are cyan, magenta, and yellow, and are known as the subtractive primaries. This is the CMY color model. It can be pictured the same way as the RGB color model, except with white as the origin instead of black. With subtractive primaries, the combination of cyan and magenta is blue, the combination of cyan and yellow is green, and the combination of magenta and yellow is red.

Note that the three additive primaries and the three subtractive primaries are all shown in the HLS color model in Figure 1. The additive primaries and subtractive primaries alternate, with the combination of each pair yielding the color in between.

> The RGB color model is ideal for specifying color on a video display.

Algorithms for converting between these various color models can be found in *Computer Graphics: Principles and Practice* by Foley, van Dam, Feiner, and Hughes (Addison-Wesley, 1990). This is the second edition of one of the true classics in the field of computer graphics. I heartily recommend it.

COLOR VIDEO HARDWARE

For the remainder of this discussion, I'll concentrate on rendering color on video displays rather than on color printers.

The RGB color model is ideal for specifying color on a video display, because it is precisely the way that video displays render color. A color monitor has three electron guns: one for red, one for green, and one for blue. Each pixel displayed on the monitor is a combination of a red, a green, and a blue dot.

Let's first assume we have a rather primitive color video board and monitor combination. With this primitive hardware, the red, green, and blue dots that define the color of the pixel can only be in one of two states: on (that is, illuminated) or off.

The memory on the video board would require 3 bits for each pixel. A 1 bit indicates that the dot is on, and a 0 bit indicates that the dot is off. The various combinations allow rendering eight different colors, as follows:

R	G	B	Color
0	0	0	Black
0	0	1	Blue
0	1	0	Green
0	1	1	Cyan
1	0	0	Red
1	0	1	Magenta
1	1	0	Yellow
1	1	1	White

But there's a little practical problem with this. There are 8 bits in a byte, and 8 is not equally divisible by 3 (the number of bits per pixel). If each byte of video memory corresponds to two pixels, then 2 bits per byte are being wasted. If we organize video memory so that no bits are wasted, then pixels would straddle byte boundaries.

IRGB COLOR ENCODING

In order to avoid this problem, the old IBM Color Graphics Adapter (CGA) and monitor introduced a fourth bit, which came to be known as the Intensity bit. This color encoding scheme was called Intensity-Red-Green-Blue (IRGB), and is shown below:

I	R	G	B	Color
0	0	0	0	Black
0	0	0	1	Blue
0	0	1	0	Green
0	0	1	1	Cyan
0	1	0	0	Red
0	1	0	1	Magenta
0	1	1	0	Brown
0	1	1	1	Light gray
1	0	0	0	Dark gray
1	0	0	1	Light blue
1	0	1	0	Light green
1	0	1	1	Light cyan
1	1	0	0	Light red
1	1	0	1	Light magenta
1	1	1	0	Yellow
1	1	1	1	White

With the CGA monitor, each color dot is capable of being in one of three different states: off, half-illuminated, or fully illuminated. Normally a monitor that was capable of three states for each color dot would be able to render 27 different colors (3 times 3 times 3). However, on the CGA monitor it is not possible for any particular pixel to have some half-illuminated dots and some fully illuminated dots. That's why the number of colors is limited to 16.

Of course, this IRGB color encoding is familiar to anyone who has programmed for the CGA or later IBM video adapters under DOS in character mode. IRGB color encoding is used for specifying the foreground and background colors of characters in the attribute byte.

The IRGB color encoding scheme may seem like a mere historical curiosity if you're doing device-independent graphics programming under the OS/2 Presentation Manager, but we'll see in the next issue that IRGB still makes its presence known in a very strong way.

ENHANCED GRAPHICS

IBM's next video adapter was known as the Enhanced Graphics Adapter (EGA). The most significant enhancement was the introduction of a graphics video mode of 640 by 350 pixels with 16 different colors. With the EGA in this graphics video mode, each pixel requires 4 bits for the 16 colors. These 4 bits normally represent a color using IRGB encoding. However, the EGA also introduced primitive palette control. Let's examine how this works.

The EGA monitor is capable of putting each of the three color dots that constitute a pixel in one of four different states: off, 1/3 illuminated, 2/3 illuminated, or fully illuminated. Unlike in the CGA monitor, the color dots for each pixel in an EGA monitor are entirely independent of each other. This means that for a particular pixel, one of the dots could be 1/3 illuminated, one could be 2/3 illuminated, and the third could be fully illuminated. Thus, an EGA monitor is capable of rendering 64 different colors (4 times 4 times 4). All this requires 6 bits of information, and the cable that connects the EGA board with the monitor has six different wires that represent a color using a color encoding scheme called rgbRGB. For red, if neither the r nor R bit is set to 1 the red color dot is off. If only the r bit is set to 1, the color dot is 1/3 illuminated. If only the R bit is set to 1, the color dot is 2/3 illuminated. If both the r and R bits are set to 1,

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the color dot is fully illuminated.

However, the EGA video board memory is organized to allow only 4 bits per pixel. The 4 pixel bits are translated into 6-bit rgbRGB colors, which are then sent to the monitor. This translation is accomplished through use of a "palette table," which is simply a lookup array with 16 6-bit entries.

The EGA BIOS loads rgbRGB values into the palette table that cause the EGA to function as if it used IRGB color encoding. However, a program using the EGA can load different values into the palette table so that the 4 bits used to specify a particular color have nothing to do with IRGB encoding.

Therefore we say that the EGA is capable of 16 simultaneous colors chosen from a palette of 64 colors.

The number of simultaneous colors a video adapter is capable of rendering is determined by the amount and organization of memory on the video board—specifically, how many bits are available for each pixel. The number of colors in the full palette is governed by the video board's palette registers and the interface between the board and the monitor.

Up to this point, all the hardware we've examined has involved digital signals (either on or off) that are sent from the video board to the monitor. Thus, the 64 different colors that the EGA monitor is capable of producing require six wires in the cable for the purpose of color control. Each pair of wires governs the four different states of one of the three color dots that comprise a pixel.

ANALOG COLOR HARDWARE

With the introduction of the PS/2 series in 1987, IBM moved to analog monitors. These monitors require only three wires in the cable for color control—one wire for red, one for green, and one for blue. The monitor can respond to different signal levels in these wires for the intensities of the three color dots. Thus, at least in theory, these analog monitors are capable of an infinite range of color.

With the PS/2 series, IBM also introduced the Video Graphics Array (VGA). When used in the 640-by-480 resolution required by the OS/2 Presentation Manager, color is specified using only 4 bits per pixel. Thus, the adapter is capable of 16 simultaneous colors.

> The number of simultaneous colors a video adapter can render is determined by the organization and amount of memory on the video board.

Some Super VGA boards can do better than that. These boards can switch into high-resolution video modes that allow using 8 bits per pixel for 256 simultaneous colors. IBM's 8514/A (when fully populated with memory) also allows using 8 bits per pixel.

The VGA (and other analog boards) also have more-extensive palette control than the EGA. Rather than the 4 pixel-bits mapping to a 6-bit color value, the 4 pixel-bits of the VGA (or the 8 pixel-bits of some Super VGAs and the 8514/A) map to an 18-bit color value. This means there are 6 bits for red, 6 bits for green, and 6 bits for blue. These 6-bit values pass through a digital-to-analog converter (DAC) to control the levels of the red, green, and blue signals sent to the monitor, as shown in Figure 3.

The use of 18 bits for deriving the color signals results in a palette of 262,144 colors (2^{18}). Thus we say that the VGA is capable of rendering 16 simultaneous colors chosen from a palette of 262,144 colors. The 8514/A and some Super-VGA boards are capable of 256 simultaneous colors, also chosen from a palette of 262,144 colors.

PIXEL-BITS AND COLOR

For the EGA and later adapters, the pixel-bits stored in video board memory mean nothing by themselves. They are merely an index into the palette lookup table. The value in the palette table is what determines the actual color associated with each unique pixel-bit value.

For example, on the VGA, a pixel-bit value of 0000 could mean red, 0001 could be light red, 0010 could mean black, 0011 could mean white, and so forth. However, as we'll see in a future column, the video display driver for the OS/2 Presentation Manager configures the VGA so that the pixel-bit values conform to the traditional IRGB encoding.

So what? Does it really matter to a PM program how the pixel-bit values map to actual colors in the palette table? After all, a PM program doesn't get anywhere near using pixel-bit values. That's all handled by the device driver.

As it turns out, the configuration of the palette table has important implications for working with raster operations and mix modes. That's why it's important to understand what's going on at the level of the hardware.

As we'll also see in future columns, OS/2 1.2 has, in theory, a facility to allow a PM program to change the palette table in the video adapter—but this has never been implemented. OS/2 2.0 adds functions that give a program extensive control over the palette. ■

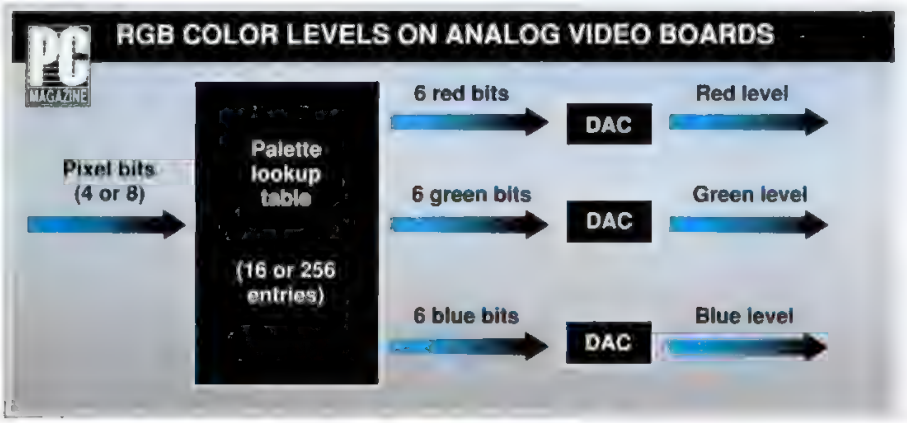

Figure 3: The mapping of pixel-bits to RGB color levels on VGA, Super VGA, and 8514/A video boards.

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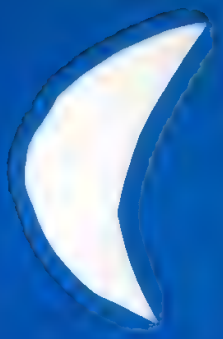

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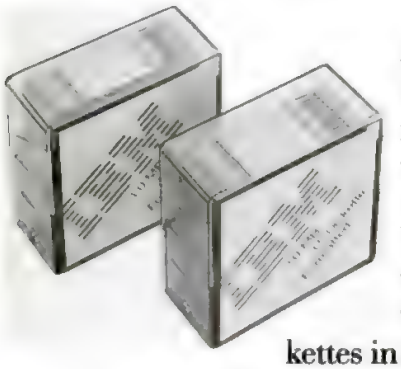

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Power Programming

An Introduction to Building Applications With ToolBook

From the user's perspective, *Microsoft Windows* is a classical, strongly object-oriented, graphical user interface. Application programs and data files are represented by icons, which can be manipulated with a mouse by clicking and dragging. In turn, icons, as well as the images and text generated by programs, are restrained within windows, which can be independently activated, positioned, and resized—again by clicking and dragging the mouse cursor.

Until recently, however, application development for *Microsoft Windows* has been performed almost entirely in plain-vanilla Microsoft C, a process analogous to building a space shuttle with a protractor, marking pen, and Swiss Army knife. Microsoft's promises of a visual or object-oriented BASIC have become shopworn and tattered as the years have passed, Microsoft C++ is still vaporware, and *Windows*-based versions of Microsoft's Quick languages have not materialized. Third-party tools vendors haven't been much help in this situation either; a great deal was promised, but unfortunately little was delivered.

But with the advent of *Windows* 3.0, the logjam in *Windows* programming tools seems to have broken. There are at least a half-dozen GUI-based development environments or code generators already shipping, with more on the way. I don't have the expertise or the energy it would take to review each of these products in-depth, but I do plan to spend the next several columns discussing two of the most important: Asymetrix's *ToolBook* and Whitewater Group's *Actor*. Both *ToolBook* and *Actor* are object-oriented, but they lie almost at opposite poles in terms of what they demand from the developer; *Actor* is directed strictly at skilled programmers, while *ToolBook* can be used effectively at some level by almost anyone.

ToolBook is characterized by its authors as a "software construction set," which is as good a description as any for an integrated environment with so many different properties and capabilities. Depending on your needs and goals, you can think of *ToolBook* as a drawing program, a flat-file database for text and images, a *Windows* shell, a product prototyper, an interactive front end to *Windows* dynamic link libraries (DLLs), or an object-oriented programming language with a built-in interpreter, incremental compiler, editor, and debugger. Michael Swaine, who has been writing about Apple *HyperCard* and its philosophical descendants (such as *ToolBook)* for several years, recently remarked: "I've taken to calling these tools *hypermedia authoring systems*, a pompous-sounding expression that is, at least, nebulous enough to capture a lot of their uses."

> ■ Depending on your needs, you can think of *ToolBook* as a drawing program, a product prototyper, a *Windows* shell, or an object-oriented programming language. *ToolBook* can be used effectively at some level by almost anyone.

A WHIRLWIND INTRODUCTION

In order to build a new *ToolBook* application, you have to deal with scripts and seven distinct types of objects: *books, pages, backgrounds, buttons, text fields, hotwords*, and *graphics*. *Scripts* are basically modular little programs written in *ToolBook*'s language, OpenScript. We'll return to OpenScript in a moment, but for now, simply note that scripts are always associated with *ToolBook* objects and are activated when a message is sent to the object (usually as a direct or indirect result of some user action, such as pointing to the object with the mouse and clicking the mouse button).

A *ToolBook* file is referred to as a *book*, and by convention its filename has the extension .TBK. A book is composed of individual records called *pages*. Only one page (or part of a page) is visible in a window at a time, although it is possible to have several windows open simultaneously, with each displaying a different page (perhaps from different files). Each page has a *foreground* and a *background*. The contents of the foreground are unique to a particular page, while the background is shared by one or more pages. A book might contain from one to many different backgrounds.

The remaining four object types—buttons, text fields, graphics, and hotwords—are the primary means of interaction with the book's ultimate user. When a new book is being built, these four object types are created, sized, assigned attributes, and located on a page (or its background) using the mouse. The design process at this stage is almost entirely visual, as it is with using a painting or drawing program; not very much interaction with the keyboard is required. Let's take a more detailed look at

each one of these four object types.

Buttons are the simplest user-manipulable objects to understand. When the user clicks a button, a script runs. The script might do just about anything, but in the most typical cases it either executes a goto statement to another page or book, or causes hidden buttons or other objects to be made visible (implementing a sort of hierarchical menu structure). Each button in a book has a unique ID number and can also be assigned a descriptive name. The button's label, which is displayed to the user, is also under the control of the developer and is distinct from the name. There are several border styles available for buttons, as shown in Figure 1. These include rectangles, rounded rectangles, checkboxes, and radio buttons. Buttons can also be *transparent*, that is, active but invisible to the user, or *shadowed*, to give them a three-dimensional appearance.

Text fields provide *ToolBook* with its database capability. Such fields contain, as you'd expect, editable text, and the text can be displayed in any of a number of typefaces, styles, and sizes. There are essentially three types of text fields to be aware of. Background text fields display the same text in the same position on all pages that share that background. Foreground text fields contain text that is unique to a specific page. Record text fields are positioned on a page's background but contain different text on each page—analogous to the fields in a data entry and display form for a traditional database. Thus, ordinary foreground and background text fields are most suitable for titles, prompts, and decoration, while record text fields are used to store variable information that you might want to search for or sort on later.

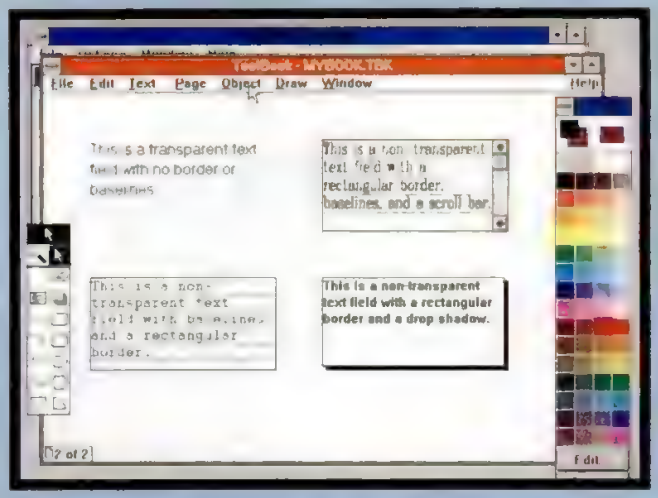

Figure 2: These are examples of *ToolBook*'s text field styles. A text field can be transparent and borderless, but more often it is made nontransparent and given one of these border styles.

Much as with buttons, each text field has a unique ID number and can also be assigned a descriptive name. A text field can be transparent and borderless, but more often it is made nontransparent and given one of the several available border styles, as shown in Figure 2: rectangle, shadowed, or with a scroll bar. Although fields can hold as many as 32,000 characters, only fields with scroll bars let you see or change text that exceeds the capacity of the field's visible frame. Consequently, *ToolBook* also allows you to assign the "single line" attribute to the field, in which case the user isn't allowed to continue typing when the visible field is full. Scripts can be associated with text fields as a whole, but this is mainly useful in fairly exotic applications, unless the text in the field is locked and the field is being used essentially as a very fancy button.

Graphics can be incorporated into a page or background in two ways. The first kind, *paint*, or bitmapped objects, can be created in another program, copied to the *Windows* Clipboard, and imported into *ToolBook* with a simple paste operation. Once the paint object is imported, it can be clipped, moved around, and hooked to a script, but it can't be otherwise modified. *Draw* objects, which are stored as mathematical descriptions rather than as bitmaps, can be created within *ToolBook* using its own graphical tools: lines, arcs, curves, ellipses, rectangles, irregular polygons, and so on (see Figure 3). Accessory menus allow you to control colors and fill closed objects with various patterns. Once a draw object is created, it can be resized or reshaped by selecting it, grabbing a handle, and carrying out the transformation directly.

Any draw object can be associated with a script, but when complex pictures are built up out of many simple draw objects, it is usually more convenient to force them into a *group* and then assign a script to the group. As mentioned previously, the most common use for a script associated with a graphic would be to create a fancier equivalent to a button, but there are other applications for graphic scripts. For example, scripts can be used to animate a graphical object, or conversely, to track the motion of the graphic while the user manipulates it directly with the mouse, and then to corre-

Figure 1: Here are some examples of *ToolBook* button shapes and sizes. A button may take the form of any of these and it may also be transparent (invisible) or shadowed (three-dimensional).

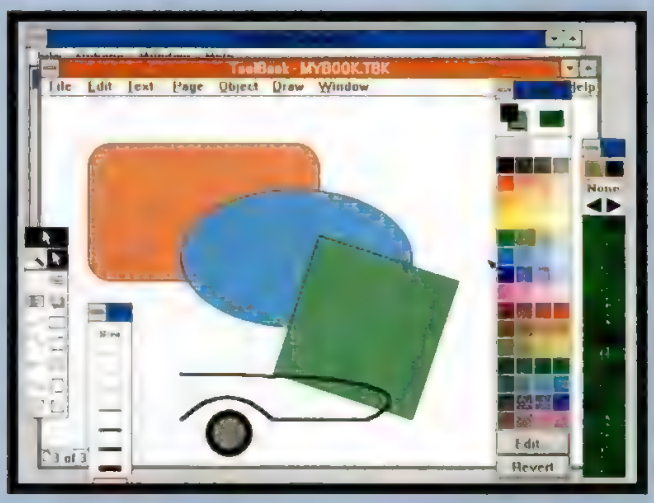

Figure 3: The *ToolBook* drawing menus, tools, and palettes are examples of graphical objects.

spondingly modify the contents of other objects.

The buttons, text fields, and graphics on a page have an obvious two-dimensional relationship to each other, which can be observed and modified directly, but they also have a less obvious three-dimensional orientation. Objects are arranged upon a page's foreground or background in layers. Each object, in fact, has its very own layer, as though it were painted on a sheet of cellophane, and an object is only visible if it is not eclipsed by objects on other, more-anterior layers. The order of object layers can be controlled either from *ToolBook* menus or programmatically. For example, you can select a specific object and "send it back" one layer at a time—and as you might expect, all the foreground layers take precedence over all the background layers.

I've left the *hotword objects* for last, because they are conceptually rather different from buttons, text fields, and graphics. A hotword object actually lies within another text field object; you define a hotword by selecting a chunk of text (which may be as small as a single character or as large as many sentences), then choosing Create Hotword from *ToolBook*'s Text menu. Once a hotword object exists, you can write a script for it. The nifty thing about hotwords is that you can still go into the text that comprises the hotword and edit it without disrupting the linkage between the hotword and the script—the hotword object persists unless you delete every single character that was in the original hotword. In short, hotwords are the primitive support for a true hypertext facility, and they are one of the features of *ToolBook* that has no counterpart in the current version of *HyperCard*.

THE OPENSCRIPT LANGUAGE

Purists don't consider *ToolBook* a true object-oriented programming environment, because it's not extensible: The possible types of objects and their relationship to each other are fixed, and new classes of objects cannot be created from existing classes. Nevertheless, programming in OpenScript has an intense object-oriented feel to it, and the language is a good match to the *Windows* architecture.

To a programmer familiar with traditional, procedural programming, OpenScript has two baffling aspects. The first is that an OpenScript program never initiates actions, it only reacts to external events,

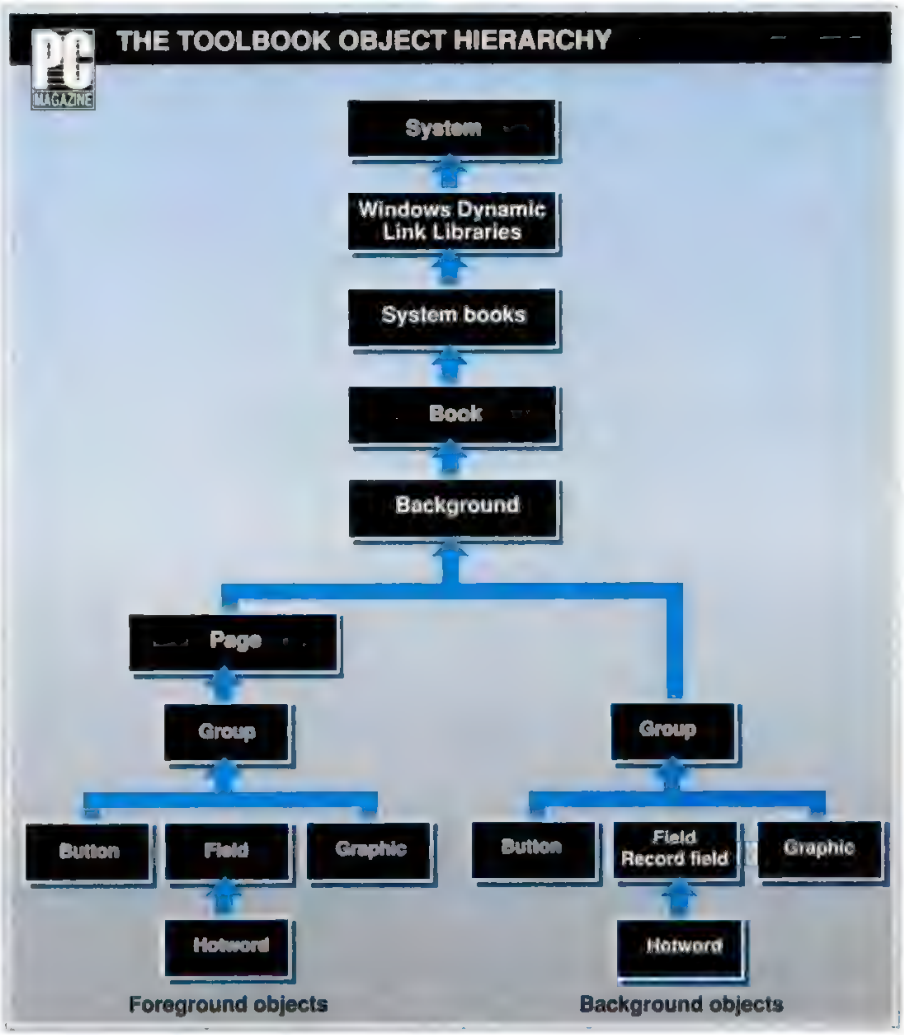

Figure 4: Event messages enter the hierarchy at the appropriate level and filter up through the hierarchy until they find a handler or reach the system level (which contains default handlers for all possible messages).

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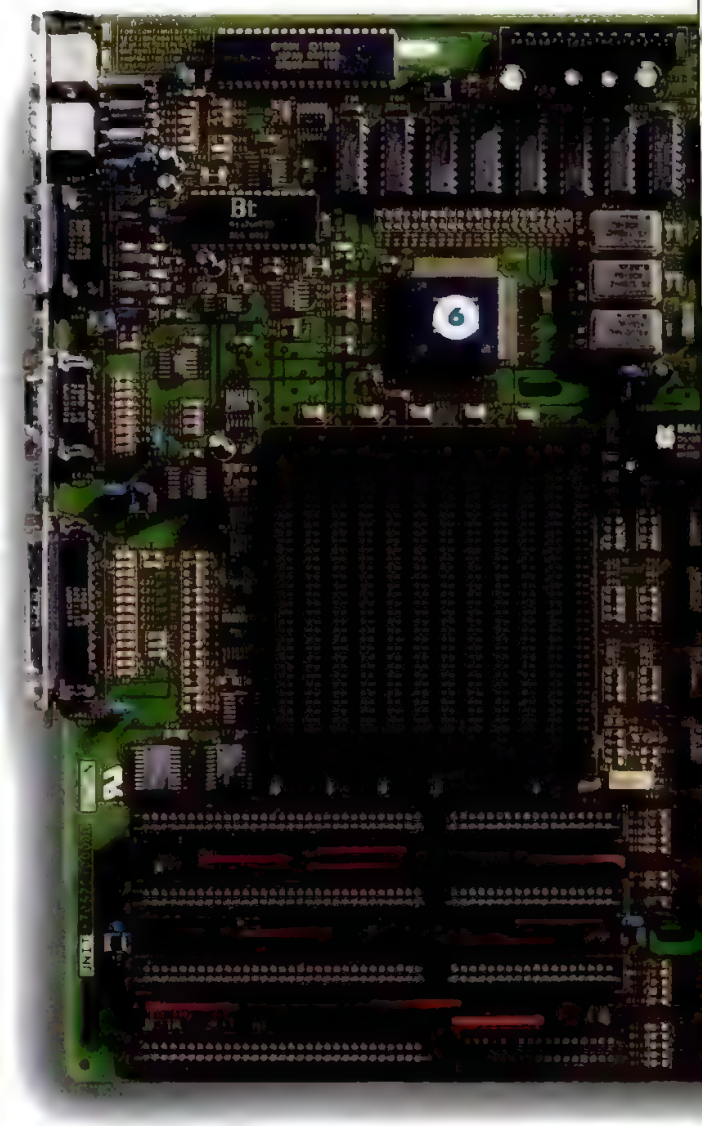

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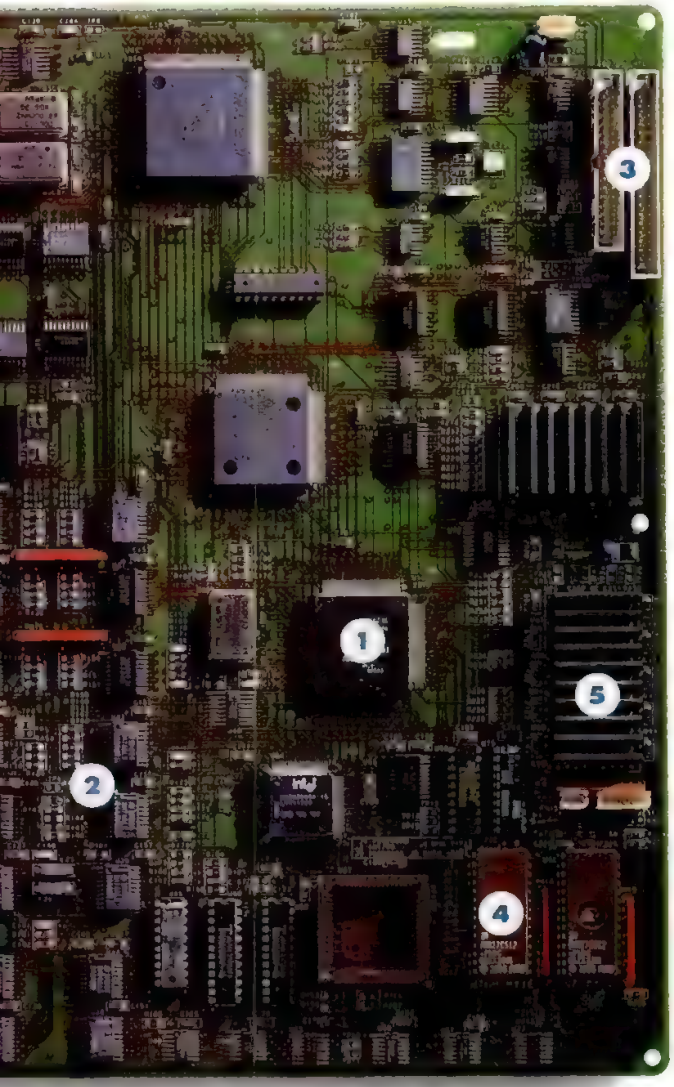

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which are reflected to the program in the form of *messages* generated by the underlying *ToolBook* runtime system. The second is that an OpenScript program for a particular book doesn't exist in any central place where you can look at it as a whole; instead, the program can be thought of as the sum total of all the scripts that are attached to objects of any kind, anywhere in the book.

Certain very simple scripts, such as a goto command to another page or book when a button is pressed, can be automatically generated and attached to an object via dialog boxes and mouse clicks, or by invoking *ToolBook*'s Watch-Me script recorder. But this capability is provided mainly for nonprogrammers. Most *ToolBook* developers will prefer to write their own scripts, and they'll find OpenScript a very powerful and natural medium.

Each script contains one or more *handlers*, whose execution is triggered by the arrival of a specific message. A handler is framed by the *to handle* and *end* keywords and contains one or more *statements*. *Statements* are built up of commands and expressions in a straightforward manner, and the flow of control among statements within a handler is determined by familiar-looking structures such as

```
do ... until
while ... end
if ... then ... else
```

as well as by the following less familiar structures:

```
conditions ... when ... when ...
 else ... end
start spooler ... end
step from ... to ... by ...  end
```

The key to successful OpenScript programming is understanding *ToolBook*'s object hierarchy (Figure 4) and repertoire of event messages (Figure 5). When an event occurs, *ToolBook* sends a corresponding message to the lowest-appropriate level of the hierarchy; if no handler for the event is present at that level, the message filters up through the hierarchy until it finds a handler or reaches the System level (which is to say, the *ToolBook* runtime system level, not to be confused with the *Windows* or DOS systems). The *ToolBook* System level necessarily contains a default handler for all messages, which is generally to consume them and take no other action.

This all probably sounds pretty vague to you, especially if you have no experience with Smalltalk or *HyperCard*, so let's examine a very simple example. Suppose that the *ToolBook* data file MYBOOK .TBK contains 10 pages (like a *dBASE* file with 10 records), that all 10 pages share the same background, and that a button with the label NEXT and the name NextButton is located in the center of the background. Further, imagine that the button has the following script:

```
to handle buttonUp
  set the invert of button
  "NextButton" to true
  pause 2 seconds
  set the invert of button
  "NextButton" to false
  fxDissolve slow to next page
end buttonUp
```

If the user moves the mouse pointer onto the button and clicks it, *ToolBook* sends a `buttonUp` event message to the button, the `to handle buttonUp` handler in the button's script is activated, and the user will see the button's border and fill colors reverse for 2 seconds, then return to normal, and finally the current page will slowly dissolve into the contents of the next page. If the user clicks the mouse outside the button, the button's handler is bypassed: The `buttonUp` message enters the object hierarchy at the next level (the script for the current page) and is either processed by a handler at one of the remaining levels or discarded.

Note one subtlety in the button's script: The `buttonUp` message is trapped, but any `buttonDown`, `buttonStillDown`, `buttonDoubleClick`, `enterButton`, and `leaveButton` messages are ignored. This allows the user to pass the mouse over the button without anything happening or to back out of triggering the button with a

TOOLBOOK EVENT MESSAGES

aboutToolBook	foreground	printReport
activateInstance	grid	properties
align	group	quickTour
author	history	reader
back	howToUseHelp	redo
background	idle	remoteCommand
backgroundProperties	import	remoteGet
bold	italic	remoteSet
bookProperties	keyChar	removeHotword
bringClose	keyDown	reshape
bringToFront	keyUp	rightButtonDouble
buttonDoubleClick	last	rightButtonDown
buttonDown	leaveBackground	rightButtonUp
buttonStillDown	leaveBook	rulers
buttonUp	leaveButton	save
changePrinter	leaveField	saveAs
character	leavePage	search
clear	leaveRecordField	selectAll
command	leaveSystem	sendFarther
copy	make	sendToBack
createHotword	mouseEnter	shortcutKeys
cut	mouseLeave	showHotwords
destroy	new	sizeToPage
drawCentered	newBackground	sort
enterBackground	newPage	startRecording
enterBook	next	stopRecording
enterButton	open	strikeout
enterField	pageProperties	toggleStatus
enterPage	palettes	topics
enterRecordField	paragraph	transparent
enterSystem	paste	underline
exit	previous	undo
first	printPages	ungroup

Figure 5: These are *ToolBook*'s event messages, which are used to notify a program that an external event has occurred.

mouse click by moving the mouse cursor off the button before lifting his finger. You can see that the existence of the other button-related messages allows you to assert very delicate control over a button's behavior.

ToolBook is a complex product, and considerations of space have forced me to gloss over or ignore altogether many of *ToolBook*'s elegant features in this short survey. For example, I haven't even mentioned *ToolBook*'s debugger with tracing and breakpoints; search-and-replace facility; user-defined functions, properties, and messages; Dynamic Data Exchange (DDE) interface; provision for extension with custom dynamic link libraries (DLLs); or fine control over color, data display formats, and printing. But I hope I've at least given you a glimmering of *ToolBook*'s richness and depth, and in the next issue of *PC Magazine*, I'll show you the step-by-step creation of an actual *ToolBook* application.

> Certain simple *ToolBook* scripts can be generated automatically. But most developers will prefer to write their own, and they'll find OpenScript to be a very powerful and natural medium.

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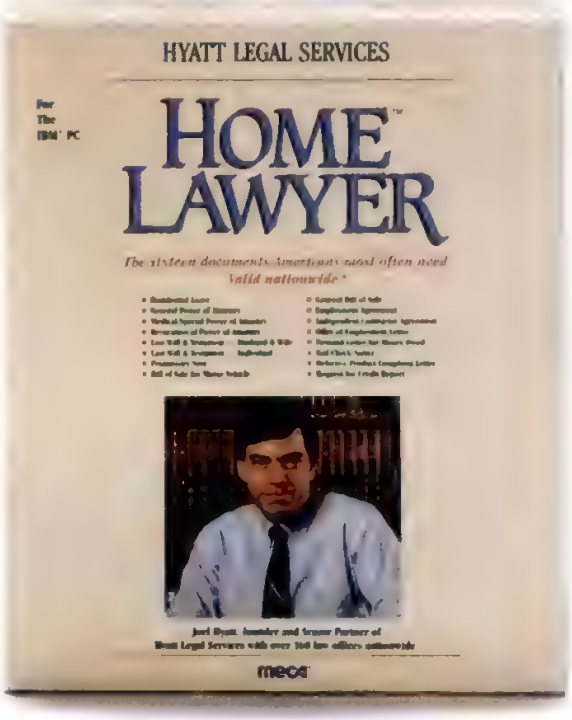

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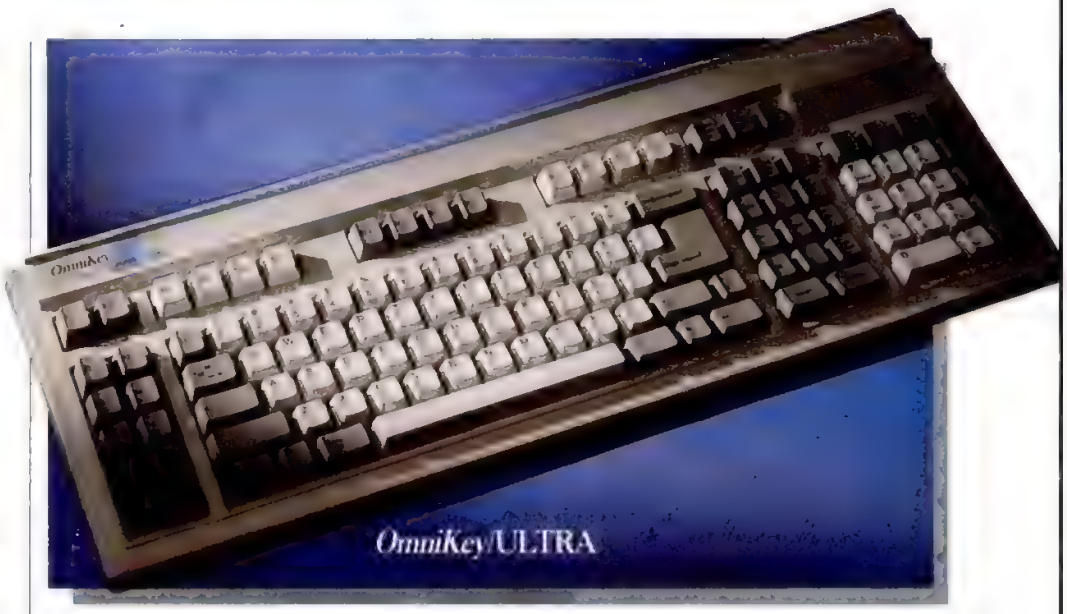

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Bridge 2.0 Tool Kit....629
Bridge 2.0 Runtime....125
C-TRIEVE/Windows (Coromandel)....349
C_talk/Views....429
C++/Views....469
CASE:W 1.2 (CASEworks)....675
CASE:W 3.0 (CASEworks)....849
Graphics Server SDK....379
Guide 3 (Owl Int'l)....439
Guide Reader (Owl Int'l)....call
Icon Author (AimTech)....call
Knowledge Pro Windows....629
Lasertalk PC....309
Microsoft SDK for Windows 3.0....349
ObjectGraphics (WhiteWater)....409
Personal Case....179
PowerLibW....265
ProtoView....595
ProtoGen....409
Pubtech BatchWorks....89
SpeedEdit for Windows....255
ToolBox (Drover)....249
The Whitewater Resource Toolkit....189
WindowsMAKER (Candlelight)....695
WinTrieve....369
Zortech C++ Compiler....179

Connectivity

APE, A Programmable Emulator....169
Business Session for Windows....269
CrossTalk for Windows....149
DaVinci eMAIL for Windows....959
DCA WindowLink for IRMA....329
DynaComm (Windows)....259
DynaComm Elite....NEW
Faxit! for Windows....179
MicroPhone II....259
Network Courier....875
TERM for Windows....169
Windows Workstation....559
WinTerm....409

PM APPLICATIONS

Active Life for PM....139
Aldus PageMaker for PM....579
Brief for OS/2....229
CASE:PM for C or C++....1895
CASE:PM for MicroFocus Cobol....2369
ChipChat (Cawthon)....279
Collage PM (Inner Media)....179
Corel Draw! for PM....call
DeScribe....529
Excel for PM (Microsoft)....349
HyperACCESS/5 for OS/2....169
Lotus 1-2-3/G....579
Micrografx Designer....489
Nexpert Object, PM Runtime....919
Object-1/PM (MDBS)....895
OS/2 PM Softset (Microsoft)....129
OS/2 PM Toolkit (Microsoft)....409
PackRat for PM....339
PackRat PM Network (3 User)....579
Perspective for OS/2....259
Q+E/PM ver 2.5....139
RT-Graphics (FSI)....959
RT-Graphics Toolkit w/source (FSI)....649
SmallTalk/V PM....339
SpeedEdit for OS/2....255
SpeedEdit for PM....255
Sytos Plus/PM (Sytron)....259
WideAngle for PM....119
Wingz (Informix)....359
WordPerfect 5.0 for OS/2....339
WinPRO/PM (Xian)....379
Zortech C++ OS/2 Compiler Option....139
Zortech C++ OS/2 Dev Edition....489

HARDWARE, etc.

Image Scanners

Logitech ScanMan 256/PC-AT....409
Logitech ScanMan 256/MCA....509
Microtek MSF-300Z....call

Video Boards

NEC Graphics Engine Brd 16 (AT)....689
NEC Graphics Engine Brd 256 (AT)....969
Paradise 8514A Plus (AT)....699
Paradise 8514A Plus (MCA)....759

Laser Printers

TI microLaser....1549
TI microLaser PS35....call

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CIRCLE 305 ON READER SERVICE CARD

by
William S. Hall

Windows

IMPROVED 8514/A FONTS

Do you use an 8514/A (or other 1,024-by-768) adapter? If so, are you tired of suffering from eyestrain when you run windowed DOS applications under *Windows* 3.0? You *can* ease the strain of reading those tiny 5-point default characters. Simply go to the [386enh] section of the SYSTEM.INI file, look for the line

```
EGA80WOA.FON=EGA80WOA.FON
```

and change it to

```
EGA80WOA.FON=8514FIX.FON
```

If you have made an 8514 installation, then 8514FIX.FON will already be in your *\WINDOWS*\SYSTEM directory. The new font makes 80-by-25 text far more readable. In enhanced mode, I now run real DOS applications in a window as a matter of course.

Robin Davies
(via PC MagNet)

I have colleagues who just love 50 lines on their VGAs, but I—like Ms. Davies—can hardly read such a display. At least *Windows* 3.0, with its new versatile setup, lets you experiment without suffering through the entire setup procedure.

If you've set up *Windows* for an 8514/A, you should find the font in your \WINDOWS\SYSTEM directory. If for some reason it's not there, copy it from *Windows* disk 1 by using the EXPAND utility and the command

```
EXPAND a:8514fix.fon \Windows
\System\8514fix.fon
```

Most of the files on the *Windows* diskettes are compressed, so you'll need EXPAND to decompress them. *Windows* includes the utility on disk 2, but for convenience, put the program into your \BIN directory or wherever you keep your utilities.

The 8514 setup is just one instance where you could change fonts to improve readability. In Ms. Davies's situation, the font used to support standard applications running in a window was increased in size. More often you find yourself with a system font too small for your display. As a result, text in menus, titles, dialog boxes, and in some applications (such as Notepad and Cardfile) may be hard to read.

- **IMPROVED 8514/A FONTS: Do you have trouble reading the fonts that *Windows* has selected for your driver? Here's how to change them.**
- **WINDOWS SHORTCUTS: Discover an easier way to display your directory tree.**

The 8514 fixed font makes the 80-by-25 text of windowed DOS applications far more readable.

For example, *Windows* supports a number of displays with vertical resolutions of 400 scan lines, such as the Olivetti/AT&T monochrome and paper-white adapters (PVC), the Olivetti OEC in 400-line mode, and the AT&T VDC750. Unfortunately, the fonts that *Windows* selects during setup are designed for the EGA, which has 350 scan lines. Such fonts appear smaller on a 400-line screen. Thus the characters may not only be difficult to read, but the combination of resolution and font may cause certain objects such as dialog boxes and menus to appear too short vertically. The VGA system fonts are taller than the corresponding EGA fonts. Here is how to make the VGA font change:

Use the EXPAND program to retrieve VGASYS.FON, VGAFIX.FON, and VGAOEM.FON from *Windows* 3.0 program disk 1 and place them into your WINDOWS/SYSTEM directory. Run the command

```
EXPAND A:VGAXXX.FON c:\Windows
\System\VGAXXX.FON
```

for each type of font (system, OEM, or fixed) and make sure to substitute *XXX* with the proper portion of the name for each file (that is, OEM, FIX or SYS). You must amend the command if your program isn't in the C:\WINDOWS directory.

Next, back up SYSTEM.INI (in case you make a mistake) and bring up the file using an ASCII text editor such as Notepad or Sysedit. Look for the lines

```
[boot]
fixedfon.fon=egafix.fon
oemfonts.fon=egaoem.fon
fonts.fon=egasys.fon
```

and substitute VGA font names for the corresponding EGA font names. Now when you run *Windows*, you will find that the system font is a bit larger and thus easier to read.

You don't have to replace the EGA typographic fonts such as HELVB.FON, TMSRB.FON, and so on. The Olivetti/AT&T screen drivers have been optimized for these fonts, and the corresponding VGA fonts will not look good in such programs as *Windows Write*.

Extended VGAs, which may have resolutions of up to 1,024 by 768, provide another situation where you may want to try a larger system font. In these cases, the VGA fonts, which look best on a display

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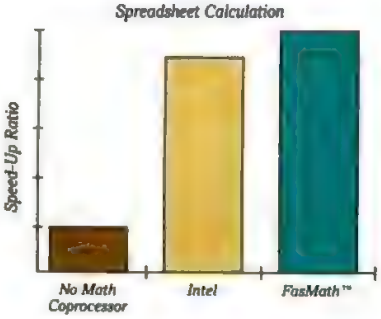

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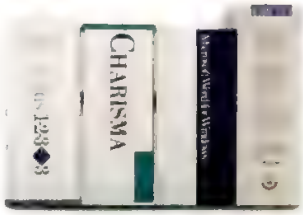

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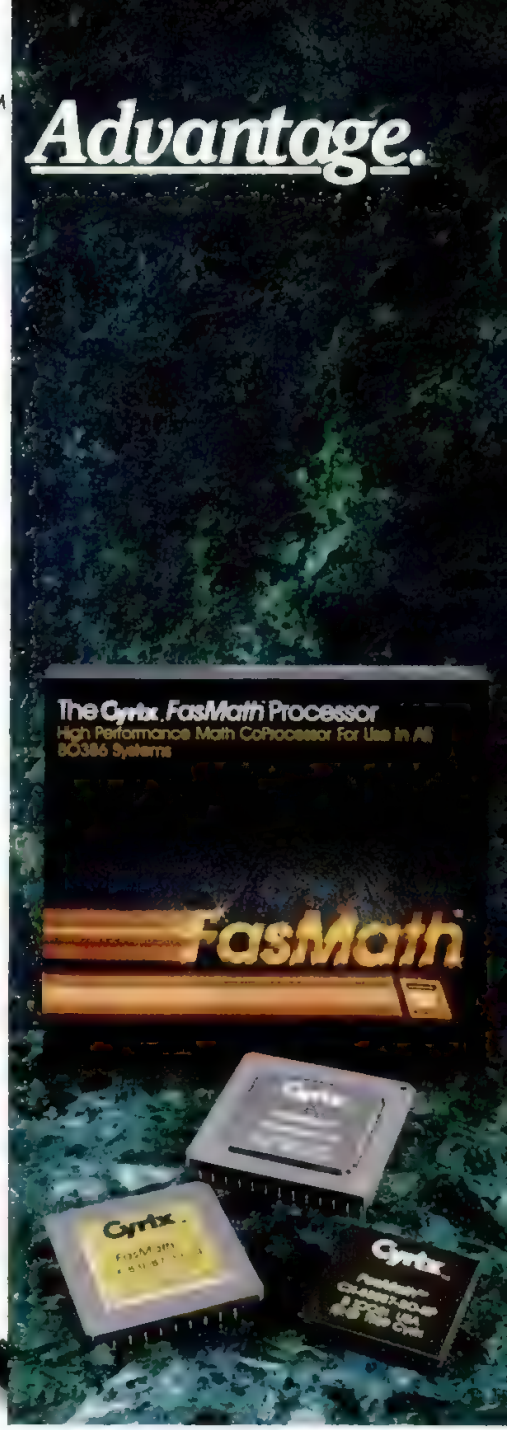

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of 480 scan lines, may be too small for your eyes at a higher resolution. If you have installed a third-party extended VGA driver with an 800-by-600 resolution or more but did not change system fonts, you may want to experiment with the 8514 fonts. Just follow the same procedure outlined above, but this time use the 8514 fixed, system, and OEM fonts. The resulting boot line in SYSTEM.INI should be

```
[boot]
fixedfon.fon=8514fix.fon
oemfonts.fon=8514oem.fon
fonts.fon=8514sys.fon
```

If you like the new look on your extended VGA display, you could replace the VGA typographic fonts as well. Using EXPAND, obtain the files

```
TMSRF.FON
HELVF.FON
COURF.FON
SYMBOLF.FON
```

from *Windows* system disk 4 and place them on your \WINDOWS\SYSTEM directory. For each file, use the EXPAND command listed above; you must substitute the correct filename and directory.

Back up your WIN.INI file and bring it up in text editor. Replace the lines

```
[fonts]
Symbol 8,10,12,14,18,24 (VGA
 res)=SYMBOLE.FON
Tms Rmn 8,10,12,14,18,24 (VGA
 res)=TMSRE.FON
Courier 10,12,15 (VGA
 res)=COURE.FON
Helv 8,10,12,14,18,24 (VGA
 res)=HELVE.FON
```

with

```
[fonts]
Symbol 8,10,12,14,18,24 (8514/a
 res)=SYMBOLF.FON
Tms Rmn 8,10,12,14,18,24 (8514/a
 res)=TMSRF.FON
Courier 10,12,15 (8514/a
 res)=COURF.FON
Helv 8,10,12,14,18,24 (8514/a
 res)=HELVF.FON
```

You will be especially pleased with the changes in the appearance of your display if your card is capable of 1,024-by-768 resolution.

WINDOWS SHORTCUTS

In the *Windows* 3.0 File Manager, you can display the directory tree of a particular drive by holding down the Shift key and clicking on the icon for that drive. This simple shortcut is a nice alternative to the Expand All menu item or the Ctrl-Shift-8 key combination.

Darrell Mullins
West Melbourne, Florida

PC MAGAZINE Thanks for sharing this useful information. I could not find this documented either in the *Windows* 3.0 manual or in Help.

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Share your experiences with the *Windows* environment. We'll pay $50 for any tips we print. Mail your contributions on-disk, with a printout, to Windows, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload them to PC MagNet (see page 8 for access instructions). ■

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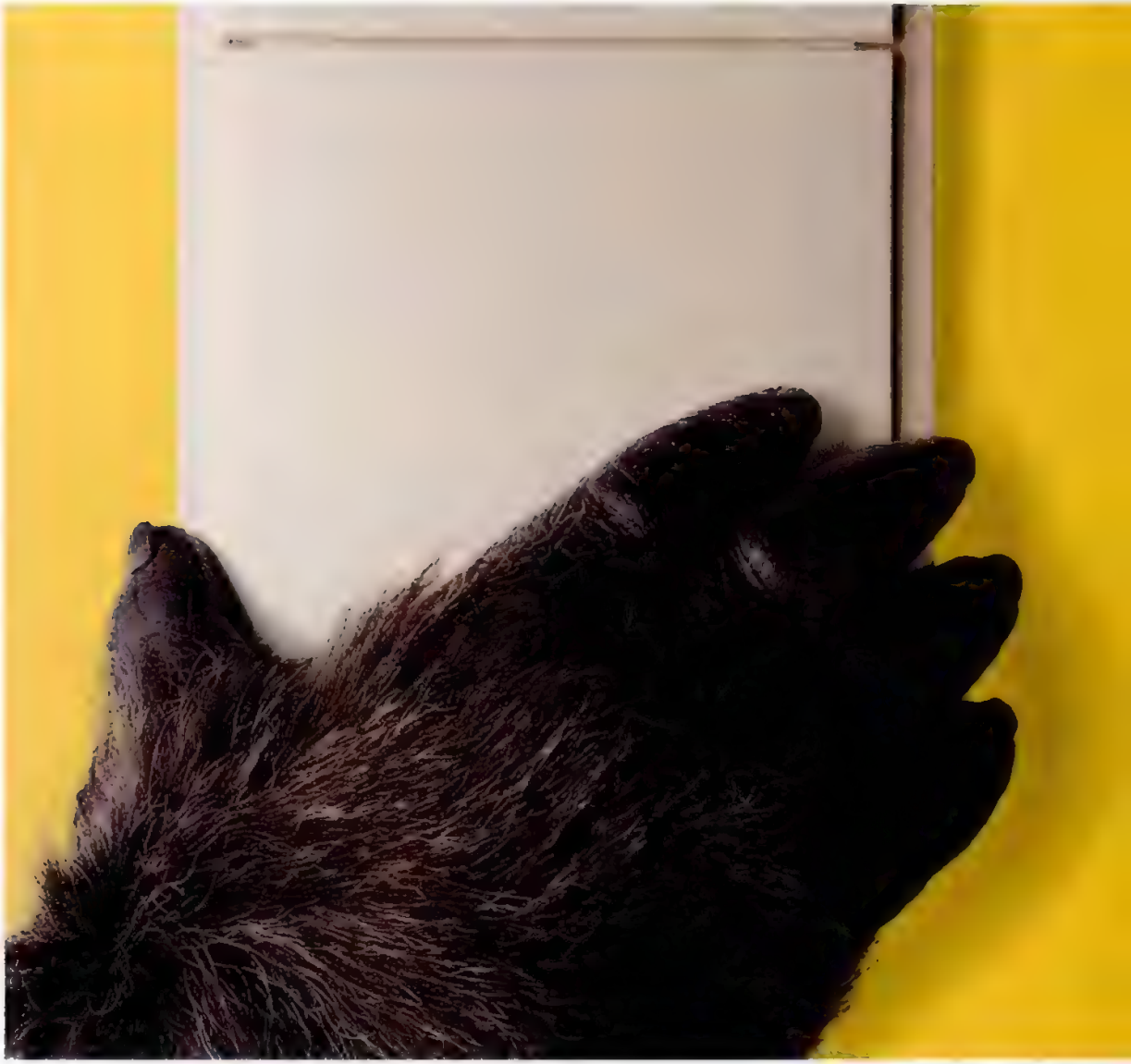

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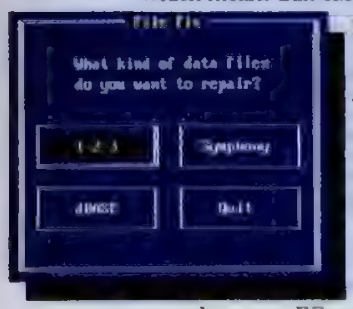

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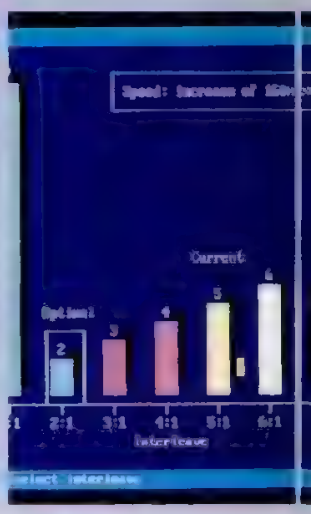

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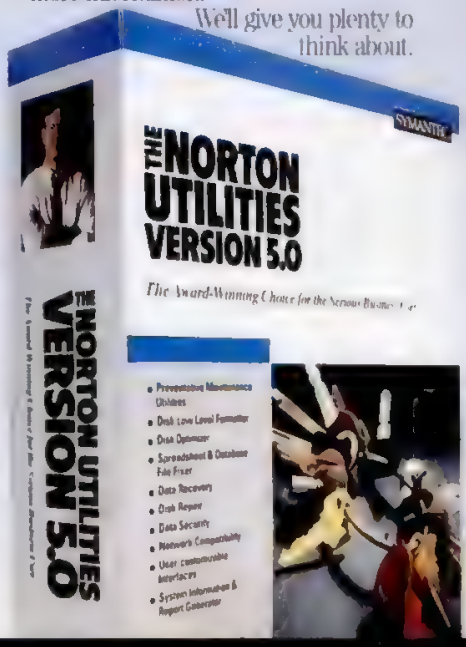

CIRCLE 733 ON READER SERVICE CARD

The new Norton Utilities 5.0 from Symantec

edited by
Trudy Neuhaus

Databases

ADVANTAGES OF R:BASE 3.0

What are the changes to the command language in *R:BASE*, Version 3.0? I hear they've added some new commands and made it more SQL-compliant. When should I use *R:BASE*'s native language and when should I use SQL? Is it worth the upgrade?

J. Brown
Alexandria, Virginia

PC MAGAZINE Microrim has made many significant changes and enhancements to the command language in Version 3.0. More likely than not, you'll have to upgrade your 2.*x* applications before you run them with 3.0.

One useful enhancement in 3.0 is the addition of descriptions. A description is a "comment" of up to 80 characters, which you attach to a specific item. When you LIST these items, the description will be displayed. For example, you can enter a description of a whole database, as well as of tables, forms, reports—even columns. Column and variable names can be up to 18 characters long.

R:BASE 3.0 has six different menu types: horizontal, vertical, bar, pull-down, and two different check-box menus. Although you can program the last four, the check-boxes may come in particularly handy. Using these, you can program ad hoc queries that in turn let the user check off the columns in a table or view that he wishes to include in a report or query.

There are also ten *dynamic* menus, that is, menus whose structures are created during program processing. Instead of putting a specific menu name in the command

```
CHOOSE <variable> FROM <menu>
```

for example, you can specify one of ten "#" variations, such as #TABLES, or #COLUMNS IN <*table/view*>. Then when the application executes this command, *R:BASE* creates a pop-up menu on the fly, listing the choices specified in the particular # command. CHOOSE now has a dynamic #WHERE IN clause; this

> ■ With an enhanced command language, description capabilities and a new menuing system, *R:BASE* 3.0 may well be worth the upgrade.

lets the user set up WHERE conditions on the fly, while still under the control of the application.

One dynamic menu that you may find yourself including often in your applications is #VALUES. This command displays all data in a particular column. It also lets the user select the proper value by moving the cursor to the option and pressing enter (in other words, a *point-and-shoot* menu). The following example uses #VALUES with the CHOOSE command:

```
CHOOSE vename FROM #VALUES FOR +
 DISTINCT lastname FROM +
 employees ORDER BY lastname
```

The BROWSE and EDIT ALL commands also work differently. When you execute either of these, you're now presented with a pull-down bar menu (called the Info/Views Menu) that gives you many new options. You can do on-the-fly sorts, rearrange the columns, edit the data, print the data, or call the Query-by-Example (QBE) menu, as shown in Figure 1.

If you're an experienced *R:BASE* user, the QBE screen will look like an enhanced version of prompt-by-example. If you've used *Paradox*, you'll feel right at home. It's very similar—right down to the checkmarks (√). You can specify what tables and columns to use in the query through the Query screen; link multiple tables together to create an ad hoc view (which you can save to use at a later time); and specify conditions for any of the columns, even if the column isn't used in the resulting table. This facility makes building on-the-fly data querys simple.

One change you'll notice when using QBE is the addition of a table identifier in front of the table name. This is in the form

```
#T1.<tablename or column>
```

and is called a *correlation name*. It's a bit confusing at first, but you'll find it makes it much easier to keep track of which col-

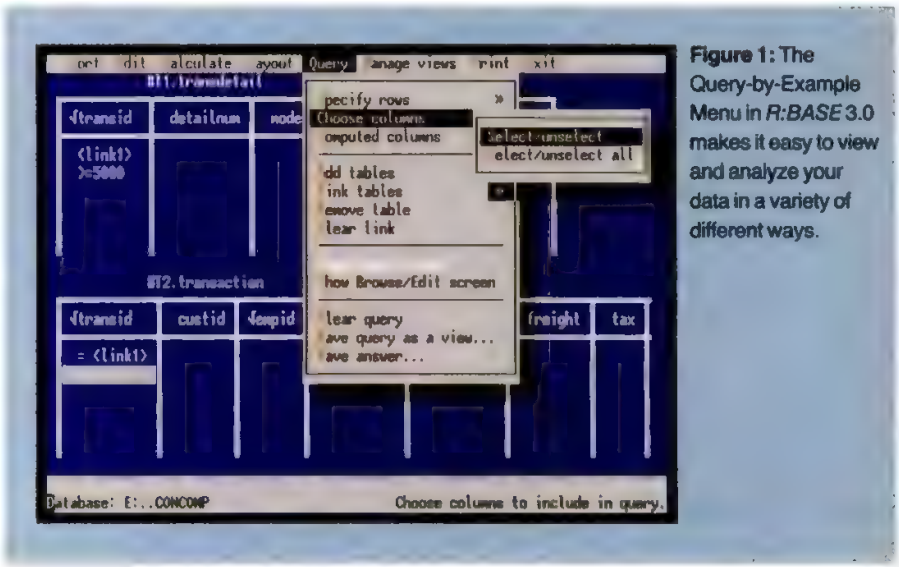

Figure 1: The Query-by-Example Menu in *R:BASE* 3.0 makes it easy to view and analyze your data in a variety of different ways.

umns you're using from which tables in multitable views.

Version 3.0 also makes many changes to the SELECT command. The SORTED BY option has been completely replaced by the SQL ORDER BY (both were valid in 2.11). SORTED BY will still work; however, it is now undocumented, so you should replace it.

GROUP BY is now SQL-compliant. It uses a HAVING clause (instead of the WHERE clause used in 2.11) to set the conditions for the GROUP BY. HAVING takes all the same arguments as WHERE and adds the ability to use SELECT functions as conditions.

The GROUP BY . . . HAVING modifier is a very powerful way of summarizing data; it lets you manipulate your data in logical clumps instead of as individual items. The easiest way to understand how it functions is with an example. Accessing the employee database using SELECT . . . GROUP BY, the user can get the average salary of all employees grouped by their respective departments. By adding a HAVING clause, the database user can determine things like which departments have average salaries higher than the overall company average.

Another enhancement to the SELECT command is the addition of the INTO clause. This lets you insert the result of the SELECT into one or more variables for later use. As you can see from the comparison shown in Figure 2, the new method is much more efficient, since only one lookup is needed to fill multiple variables. Also, notice that the variable and column names are easier to read, thanks to the increased 18-character limit.

The SET VARIABLE command now lets you set multiple variables in one command, and you can get the values from a view as well as from a table. Thus, the example of Version 2.11 shown in Figure 2 now can be written as

```
SET VAR vfrname = frname, +
  vlsname = lsname, IN emp +
  WHERE + ssn = 123-456-7890
```

INSERT replaces APPEND and expands its function. You can use all the options of the SELECT clause to determine what data to add to a table, such as grouped data, or

> *R:BASE* 3.0 has a SWITCH . . . ENDSW structure that makes multilevel logic much easier to program.

even data from multiple tables. APPEND is still backward-compatible, but you should check your application and replace it with INSERT.

R:BASE 3.0 replaces the old SET POINTER and NEXT commands (used to step through a table) with a new set of SQL-compliant commands. This is a prescription for trouble, unless you update your applications. Figure 3 compares the old with the new. The OPEN and CLOSE commands are no longer used to open and close a database; they've been replaced by CONNECT and DISCONNECT.

DECLARE <cursorname> CURSOR now takes named cursors (as opposed to numbers), and the three-cursor limit has been removed. OPEN <cursorname> puts the cursor on the first row of the table, and FETCH is used to move the cursor through the table, putting the values from each row into variables. CLOSE <cursorname> is used to close the currently open cursor and free up the memory it's using; DROP CURSOR is used to remove the cursor definition completely.

While the new version may seem more verbose, it's much easier to understand. It also demonstrates how OPEN and CLOSE now work and that the FETCH command auto-loads all the specified variables at the same time. The WHENEVER command is used for error trapping; we'll discuss it in more detail later on.

R:BASE 3.0's ENHANCED SELECT COMMAND — **COMPLETE LISTING**

```
R:Base 2.11:

SET VAR vfrname = frname IN emp WHERE ssn = 123-456-7890
SET VAR vlsname = lsname IN emp WHERE ssn = 123-456-7890

-----------------------------------------------------------

R:Base 3.0:

SELECT firstname lastname INTO vfirstname, vlastname FROM +
  Employees WHERE socialsecurity = 123-456-7890
```

Figure 2: The INTO clause in *R:BASE*, Version 3.0, lets you insert the result of the SELECT into one or more variables for later use. Since only one lookup is required to fill multiple variables, this method is much more efficient than the one in Version 2.11.

OTHER NEW COMMANDS

One of the biggest complaints of *R:BASE* programmers has been the lack of a SWITCH structure; any program logic was dependent on a series of IF . . . ENDIF statements.

Complain no more: *R:BASE* 3.0 has CASE statements as part of a SWITCH . . . ENDSW structure, making multilevel logic easier to program. These statements can also be nested to as many levels as memory allows.

Another nice addition is the AUTONUM command. This lets you set up a column where each number is a defined increment of the previous number, and each number is unique. Performing this task prior to 3.0 required a complicated program module using the SET POINTER and NEXT commands to determine the next unique value (the whole procedure would fill a column on this page!). You can also set a display format with AUTONUM, and use it for TEXT columns. This is ideal for handling distinctive formats such as serial numbers (SN#0001, for instance.)

Version 3.0 adds a set of keystroke commands that let you define how special keys (such as the function keys) are handled. CHKKEY checks to see if a key is waiting in the keyboard buffer; GETKEY is then used to get the value of the first key in the buffer. This value can be compared and used to determine program logic. Using CHKKEY and GETKEY together is recommended, since GETKEY will just wait for the next keystroke if one is not available in the buffer.

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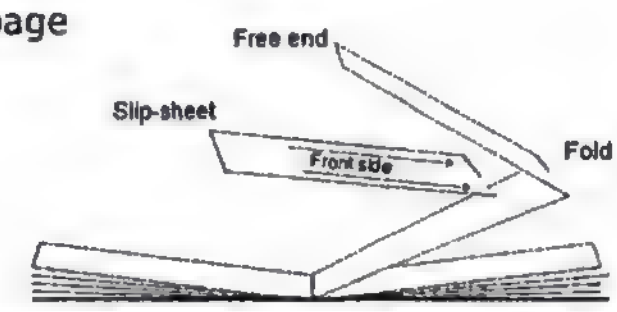

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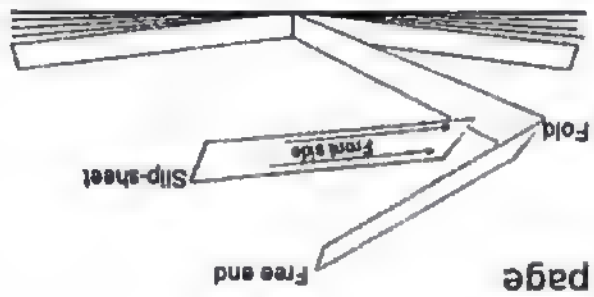

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user (the last one in the buffer). This command is particularly handy when using FILLIN commands. For example, instead of waiting for the user to fill in a value, FILLIN can trap the Esc key and abort.

It's quicker than ever to design a custom interface for your applications with SNAP. This command lets you take a snapshot of all or part of the screen, and saves it to a text file. You can then view the file using the DISPLAY command. This speeds development time, making it easy to create custom screens for features such as context-sensitive help.

R:BASE has always been strong in its multiuser capabilities and Version 3.0 is no exception. It introduces many new network commands, all of which are SQL-compatible. Automatic screen refresh, which updates the screen when another user makes a change to the database, is probably the most important new addition. You use SET REFRESH to set the time period between auto-refreshes. And SET NAME lets you set a user name for a workstation node. You can also use SET NAME with ENVVAL if you'd rather set a user name from an environment variable.

For example, an AUTOEXEC.BAT file of a workstation could have

```
SET uname=SMITH
```

Then, in your application you can use the following to automatically set the user's name, and thus, his security rights:

```
SET VAR workstation +
  =(ENVVAL('uname'))
SET NAME .workstation
```

STRUCTURED QUERY LANGUAGE (SQL)

To date, most *R:BASE* commands have been SQL-based. Sometimes they had different names or modifiers (for example, SORTED BY instead of ORDER BY). However, *R:BASE* never used SQL keywords to mean something different from their SQL definition. With Version 3.0, Microrim adds full support for ANSI Level 2 SQL (1986 version) with IBM DB2 extensions. And unlike other database management systems that add an SQL interpreter, *R:BASE* makes SQL an integral part of the command language. Unfortunately, you can't use *R:BASE*'s SQL commands to access other SQL systems (such as a SQL server); they operate only with the *R:BASE* environment.

Version 2.11 included limited support for the SQL GRANT and REVOKE access-right commands. Version 3.0 brings these up to full SQL compatibility, giving you the ability to let users GRANT their rights to other users. The ALL modifier in Version 2.11 is now ALL PRIVILEGES, which may cause problems if you run old applications. Figure 4 lists some new SQL commands along with some from Version 2.11 that are now SQL-compliant.

USING SQL-COMPLIANT COMMANDS

```
R:Base 2.11:

SET POINTER #3 emp3 FOR emp WHERE lsname = Smith AND +
  fsname = John SORTED BY lsname
WHILE emp3=0 THEN
  SET var vsalary = salary IN #3
  {do something with Smith's salary}
  NEXT #3 evar3
ENDWHILE

-----------------------------------------------------------

R:Base 3.0:

WHENEVER NOT FOUND GOTO SkipIt
DECLARE CURSOR review FOR SELECT salary, hiredate FROM +
  Employees WHERE lastName = Smith ORDER BY lastname
OPEN review
FETCH review INTO vsalary, vhiredate
WHILE ((IYR(#DATE)) - (IYR(.vhiredate))) >= 1 THEN
  FETCH review INTO vsalary, vhiredate
  {do something with Smith's salary}
ENDWHILE
CLOSE review
LABEL skipIt
```

Figure 3: The second code sample not only shows the substitution on the new commands for the ones in Version 2.11, but how much more you can do within the same function in Version 3.0.

> *R:BASE* 3.0 introduces many new network commands, all of which are SQL-compatible.

Of particular interest is SQL transaction processing, especially in multiuser applications. Transaction processing preserves data integrity by letting you perform a group (or batch) of functions together without making changes to the actual database until all commands complete without errors. This is designed for projects, such as monthly account posting or making changes to multiple tables, that are dependent on each other.

SET TRANSACTION <ON/OFF> turns transaction processing on and off for the entire database or for a set of commands. SET MAXTRANS sets the number of users that can be accessing the database at the same time while transaction processing is active. The default is 10, but you can use values from 1 to 255.

Four commands control how data is processed while transaction processing is on. SET LOCK <ON/OFF> controls table locking while a transaction is being processed. COMMIT tells *R:BASE* to make the transaction permanent, and ROLLBACK tells *R:BASE* to undo and discard the changes made in the transaction. (Note: once you COMMIT, you can't ROLLBACK.) The SET AUTOCOMMIT <ON/OFF> command determines how each command is processed. When transaction processing is on, AUTOCOMMIT ON treats each individual command as a transaction, committing it as soon as it's executed (COMMIT and ROLLBACK statements are ignored). With AUTOCOMMIT OFF, the transaction is not completed until a COMMIT statement is encountered. System overhead is higher when AUTOCOMMIT is on, so it should be used only when necessary.

Another important command introduced with Version 3.0 is WHENEVER; this is an "asynchronous" command, such as BASIC's ON ERROR, that traps SQL errors. WHENEVER the specified event

occurs ("data not found" or a SQL error, for example), the specified action takes place (usually a jump to an error handler). Depending on the error, the handler may use a GOTO to transfer command back to the main program, which is easy to do if you store the name of a label to return to). This command is especially important to use during transaction processing; it helps prevent corruption of your data by jumping to a ROLLBACK command, should some error occur.

SQL VS. R:BASE COMMANDS

As *R:BASE* has evolved from the original *R:BASE 4000* to *R:BASE* 3.0, its command language has moved closer to full SQL compatibility. In prior versions, it was easy to say when you should use the *R:BASE* native language and when you should use its SQL capabilities. In 3.0, it's almost impossible to draw that distinction, since SQL is tightly integrated into the *R:BASE* command language. Anyone with knowledge of SQL can start programming in *R:BASE* with little or no difficulty.

R:BASE programmers who want to be ready to move to a SQL server should start using the full SQL extensions to the command language. Programmers writing a multiuser application can (and should) incorporate the SQL transaction processing into their programs, to take advantage of the additional data integrity provided.

R:BASE 3.0 includes many new commands and features that have been requested over the years, as well as an entirely new interface; but there is a price. The RAM requirements of the program have grown to 520K, and some of its command routines are slower than they were in *R:BASE* for DOS, Version 2.11. This has the biggest impact on multiuser LAN-based applications. Even a 386 using one of the 386 memory management programs to move LAN drivers to high memory may barely have enough memory to run *R:BASE* itself, and you quickly find yourself getting insufficient memory errors when attempting to access large databases.

> As *R:BASE* has evolved from the original *R:BASE* 4000 to *R:BASE* 3.0, its command language has moved closer to full SQL compatibility.

Microrim is aware of the RAM and speed problems, and has addressed this in Version 3.1 which the company will be releasing as a free upgrade to owners of 3.0. (It might even be released by the time you read this.) Microrim doesn't anticipate incorporating any changes to *R:BASE*'s features or command language in the new release. However, there are plans to build in compatibility with database files from other vendors; Version 3.1 will directly read and write *dBASE III* and *III Plus* files, including indexes and simultaneous access with *dBASE* users on a network. So if you haven't upgraded already, there's no reason to wait any longer.

SQL COMMANDS IN R:BASE

Command	Description
Data Definition Language	
ALTER TABLE	Add columns to a table
COMMENT ON	Add a comment to a database, table, and so on
CREATE INDEX/DROP INDEX	Add or remove an index on a particular column
CREATE TABLE/DROP TABLE	Add or remove a table
CREATE VIEW/DROP VIEW	Add or remove a view
CREATE SCHEMA/AUTHORIZATION	Create a database with access rights
Data Manipulation Language	
DELETE	Delete rows or duplicates from a table
INSERT	Insert data directly into a table or view
SELECT	Select data from a table or view
UPDATE	Update existing data with new values
SQL Programming Control	
OPEN	Programming commands to point
DECLARE CURSOR	to specific rows in a table
FETCH	and manipulate the data
CLOSE	in those rows
DROP CURSOR	
--(*comment*)	Put a comment into the code
WHENEVER	SQL error-code processing
Data Security Language	
CONNECT	Open a database
DISCONNECT	Close a database
GRANT	Set access rights to the database
REVOKE	Remove access rights
Transaction Processing	
SET TRANSACT	Turn transaction processing on or off
SET MAXTRANS	Set number of users during transaction processing
SET LOCK	Set and remove table locks during transaction processing
COMMIT	Make transaction permanent
SET AUTOCOMMIT	Toggle whether an explicit COMMIT is needed
ROLLBACK	Discard changes made in a transaction

Figure 4: This table lists the ANSI Level 2 SQL commands in *R:BASE* 3.0 with brief descriptions, grouped by function.

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Share your database experience, tips, and techniques, and we will pay you $50 for any submissions that we print. Submissions must be made on-disk, and be sure to include a printout. Mail your contributions to Databases, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload them to PC Magnet (see the "By Modem" sidebar in the Utilities column for instructions.) ■

Research for this article was provided by Joe Salemi, who has worked with PCs for over 9 years and is now a project manager for a federal government LAN project.

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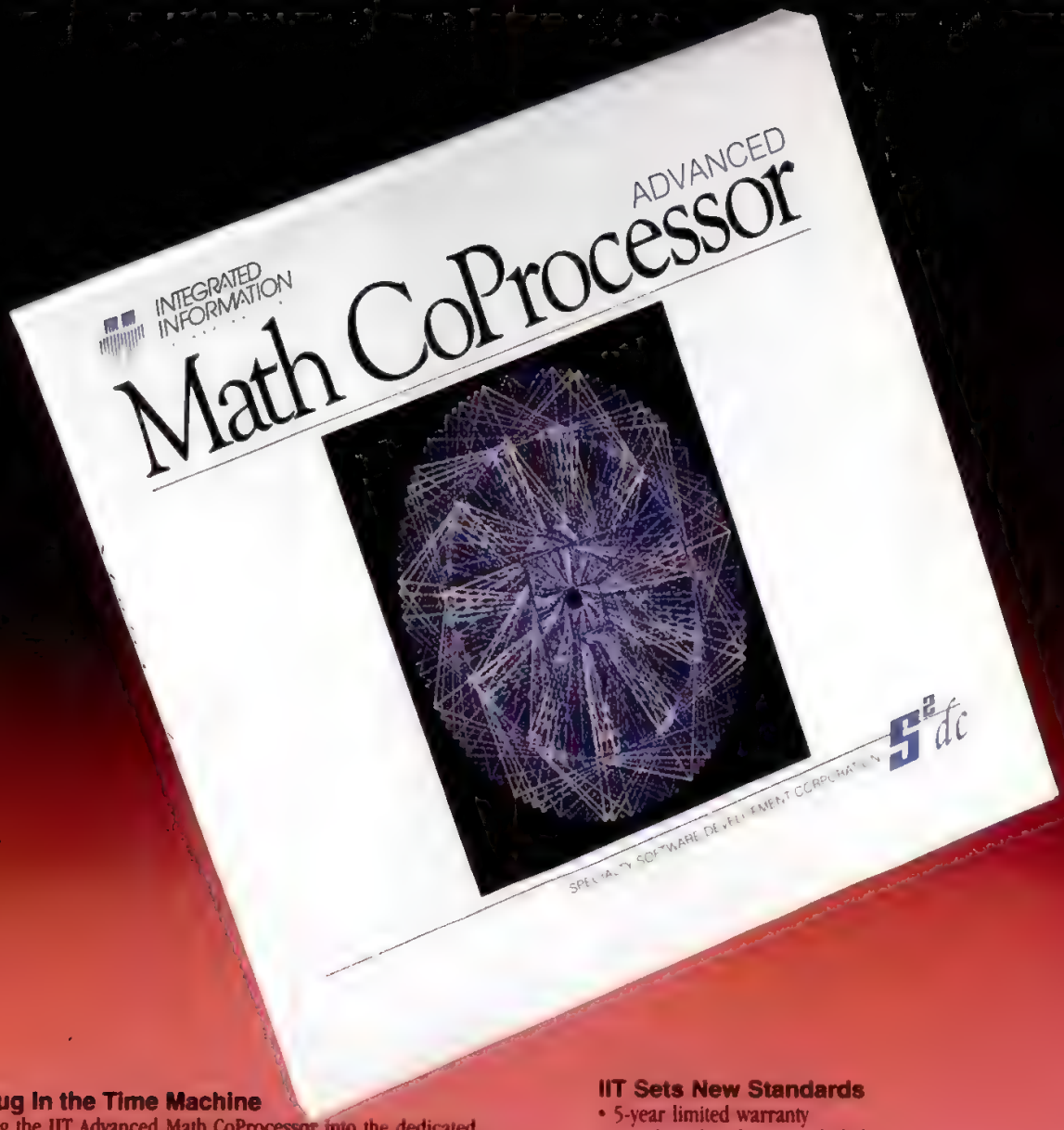

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Spreadsheets

CREATE MENUS AND COMMANDS IN EXCEL

In my office I have *Lotus 1-2-3* and *Microsoft Excel* users, and I wanted to find a quick, convenient way to load .WK1 and .XLS files into *Excel*. After reading about *Excel*'s Add.Menu macro command (Spreadsheets, July 1990), I devised the solution.

The macro listed in Figure 1 adds a Chdir menu to several of *Excel*'s menu bars and an Open 1-2-3 command to the File menu on these same menu bars. The Chdir menu lets me switch easily between two data directories, one for *Excel* files and another for *1-2-3* files. Click the Open 1-2-3 command and *Excel* presents a custom dialog box modeled after the one associated with the File Open command. The default file specification in the dialog box is *.WK*, instead of *.XL*, so you can scroll through filenames and load any *1-2-3* worksheet into *Excel* with a double-click.

I've named the macro Auto_open, so it runs automatically whenever the macro sheet is loaded into memory. I've used the File Properties command in the *Windows* 3.0 Program Manager to associate the macro sheet with the *Excel* program file, EXCEL.EXE. Thus, when one of my users starts the program, *Excel* immediately installs the Chdir menu and Open 1-2-3 command.

Dave Elkodsi
Trumbull, Connecticut

One of the most ingratiating features of *Excel* is the freedom it gives you to modify its menu system. Add commands to existing menus, add your own menus to the six standard menu bars, or create entirely new menu bars. Even custom dialog boxes are well within reach of the moderately ambitious user, thanks to the Dialog Editor, a separate utility shipped with *Excel* 2.1 and 2.1c. As Mr. Elkodsi's example shows, it's quite simple—simpler than it may at first appear—to use *Excel*'s customizing tools. Let's take a quick stroll through his Auto_open macro to see how it works.

■ CREATE MENUS AND COMMANDS IN EXCEL: Use customizing tools to build a smoother integration of *Lotus 1-2-3* and *Microsoft Excel* files.

The main business of the macro takes place in cells A2:A15. The first two statements (A2:A3) hide the macro sheet and open a new worksheet. The next five statements (A4:A8) add a Chdir menu to five of *Excel*'s six standard menu bars. The following five statements (A9:A13) put a new command—called Open 1-2-3—on the File menu of the same five menu bars.

It's simpler than it may appear to use *Excel*'s customizing tools.

The statement in A14 makes Mr. Elkodsi's *Excel* data directory the current directory, and the RETURN() statement in A15 ends the macro. (When adapting this macro for your own use, be sure to modify A14 and all path references in the macro to specify a directory on your own system.)

The statements in A2 and A3 are designed to mimic *Excel*'s normal start-up appearance. Mr. Elkodsi has used Program Manager to associate his macro sheet with the EXCEL.EXE, so *Excel* always starts with ELKODSI.XLM and no blank worksheet on the screen. The HIDE() statement then removes the macro sheet from view (but not from memory), and the NEW() statement puts a fresh blank worksheet, named SHEET1, onto the screen.

The ADD.MENU statements in cells A4:A8 add a new menu to the "full menus" and "short menus" variants of the Worksheet/Macro menu bar, the full and short variants of the Chart menu bar, and the so-called "nil" menu bar (the menu bar that appears when you have no open documents on your screen). Each of these statements has two arguments. The first argument identifies the number of the menu bar to be modified; you'll find a list of the standard menu-bar numbers on page 246 of the *Excel Functions and Macros* manual. The second argument indicates an area of the macro sheet in which the Chdir menu is described.

Each of Mr. Elkodsi's ADD.MENU statements points to this same area of the macro sheet—A17:B19. Cell A17 tells *Excel* to name the new menu Chdir, and cells A18 and A19 indicate that the menu will include two commands: Lotus 1-2-3 Files and Excel Files. The ampersands in A17, A18, and A19 won't appear in the menu name or command names; they tell the program to underline the letters that follow—the C in Chdir, the L in Lotus, and the E in Excel.

Cells B18 and B19 specify the actions *Excel* should take when you choose the new commands on the Chdir menu. Each of these cells points to another macro routine. When you choose Lotus 1-2-3 Files, *Excel* executes the commands in the range named `lotus` (A22:A23). When you choose Excel Files, the program carries out the instructions in the range named `excel` (A26:A27). These routines are both very simple; all they do is change the current directory. But you could attach a macro of any size to a new menu command. Two warnings are in order here: Be sure to modify cells A22 and A26 to specify directories that exist on your system. Moreover, if you change the name of the macro sheet, be sure to substitute the new name for the ELKODSI.XLM reference in the formulas in B18, B19, and B29.

The ADD.COMMAND statements in

A9:A13 add a new command to the File menu on the same five menu bars that were modified by the ADD.MENU commands. Each ADD.COMMAND statement takes three arguments. The first provides a menu-bar number, the second names the menu to be modified, and the third supplies a macro-sheet range in which the new command itself is described. The second argument can be either a text string (as it is in Mr. Elkodsi's macro) or a number. If it's a number, the argument represents the position of the menu to be altered. On the standard *Excel* menu bars, the File menu is always the first menu (ignoring the Control menu, which can't be modified), so you could substitute a 1 for the string "File" in these ADD.COMMAND statements.

Each of Mr. Elkodsi's five ADD .COMMAND statements points to the same two-cell range—A29:B29. A29 names the new command Open 1-2-3 (with the 1 underscored), and B29 points to yet another macro-sheet range, named Open_Lotus. Here, the actions to be carried out by Open 1-2-3 are defined.

A32, the first cell in the range named Open_Lotus, makes Mr. Elkodsi's Lotus directory current. The DIALOG.BOX statement in A33 displays the custom dialog box shown in Figure 2. This dialog box is defined by the contents of range B41:H53; we'll return to these instructions in a moment.

If you do nothing but look at the dialog box and click the Cancel button, the IF statement in A34 causes *Excel* to skip down to A38. The =RETURN statement here prompts the Open_Lotus routine to conclude its business and return *Excel* to its normal interactive state. If you do choose a file in the dialog box, the statement in A35 closes the current worksheet (*Excel* prompts you to save if you've modified the worksheet). The statement in A36 opens the selected file, the statement in A37 resets the dialog box so that it will display *.WK* again the next time you invoke it, and the statement in A38 ends the macro.

The dialog box is defined in the range B41:H53. The text that surrounds this range in row 40 and column A is only commentary. It's not required, but it helps clarify the information in B41:H53.

The dialog box consists of 12 elements, each of which is described on one row of the range. For each element, up to seven items of information may be provided (not all are required for every element). These items are arrayed across columns B through H in Figure 1.

Column B specifies the element type as a number from 1 to 20. You'll find a list of all 20 element types on pages 212 to 215 of the *Excel Functions and Macros* manual.

Columns C and D provide the *x* and *y* screen coordinates of the upper-left corner of each element. The coordinates for the dialog box itself appear in columns C and D of the first row of the range—row 41 in Figure 1. If you omit this information for any element or the dialog box itself, *Excel* will provide default positions.

Columns E and F specify the width and height, respectively, of each element. The unit of measurement is the pixel in whatever display system you're using. If you omit this information, *Excel* again provides default values.

Column G specifies the text that will appear in a dialog box element—the OK in an OK button, for example. You can make your OK button say "Accept" or "Go For It" or whatever you want.

Column H contains any initial values you want to assign to a dialog-box element. In Figure 1, for example, H47 tells *Excel* that the Open 1-2-3 dialog box should initially list all files matching the wildcard specification *.WK*.

Column H also records any values selected by the user of the dialog box. After the user selects a file, for example, H47 will record the name of that file and the macro instruction in A36 will use that information to open the requested file.

The good news about all of this is that you don't have to fill out the dialog box specification by hand. If you're using *Excel* 2.1 or later, you can create a dialog box in a matter of minutes with the help of Microsoft's Dialog Editor. Just pull down the *Excel* Control menu, choose Run, and select Dialog Editor.

The initial Dialog Editor screen, shown in Figure 3, looks a little like a drawing package with a miniature canvas. The canvas represents your nascent dialog box; you can make it bigger or smaller by dragging its borders. To populate the dialog box, you choose commands on the Item menu. Once you've chosen an element,

ADDING MENUS AND DIALOG BOXES — **COMPLETE LISTING**

```
      A                                    B            C   D   E    F    G          H
 1  auto_open
 2  =HIDE()
 3  =NEW()
 4  =ADD.MENU(1,A17:B19)
 5  =ADD.MENU(2,A17:B19)
 6  =ADD.MENU(3,A17:B19)
 7  =ADD.MENU(5,A17:B19)
 8  =ADD.MENU(6,A17:B19)
 9  =ADD.COMMAND(1,"File",A29:B29)
10  =ADD.COMMAND(2,"File",A29:B29)
11  =ADD.COMMAND(3,"File",A29:B29)
12  =ADD.COMMAND(5,"File",A29:B29)
13  =ADD.COMMAND(6,"File",A29:B29)
14  =DIRECTORY("C:\WINDOWS\EXCELDAT")
15  =RETURN()
16
17  &Chdir
18  &Lotus 1-2-3 Files                  ELKODSI.XLM!lotus
19  &Excel Files                        ELKODSI.XLM!excel
20
21  lotus
22  =DIRECTORY("C:\lotus\lotusdat")
23  =RETURN()
24
25  excel
26  =DIRECTORY("c:\windows\exceldat")
27  =RETURN()
28
29  Open &1-2-3                         ELKODSI.XLM!Open_Lotus
30
31  Open_Lotus
32  =DIRECTORY("c:\lotus\lotusdat")
33  =DIALOG.BOX(B41:H53)
34  =IF(H47="*.wk*",GOTO(A38))
35  =CLOSE()
36  =OPEN(H47,3,H44)
37  =SET.VALUE(H47,"*.wk*")
38  =RETURN()
39
40  comment                             item        x    y   width  height   text        init/result
41                                                  40   33  448    195
42  ok button default                   1           368  6   72              OK
43  cancel button                       2           368  31  72              Cancel
44  read only check box                 13          344  140             Read Only   FALSE
45  directory is text                   5           8    5                  Open 1-2-3
46  Open 1-2-3 menu                     5           8    31                 File &Name:
47                                      6           188  27  192                         *.wk*
48  text box                            5           8    78                 &Files
49  linked file list box                18          8    85  152    92
50  text box                            5           168  78                 &Directory
51  linked drive/directory box          19          168  85  168    93
52  text box                            5           184  56  176
53  text box                            5           188  56                 Directory is
```

Figure 1: This macro adds a Chdir menu to five *Excel* menu bars; the new menu lets you switch easily between directories for *1-2-3* and *Excel* files. The macro also adds an Open 1-2-3 command to the File menu on these same five menu bars. Select the new command and *Excel* pops up a dialog box modeled after its own File Open original.

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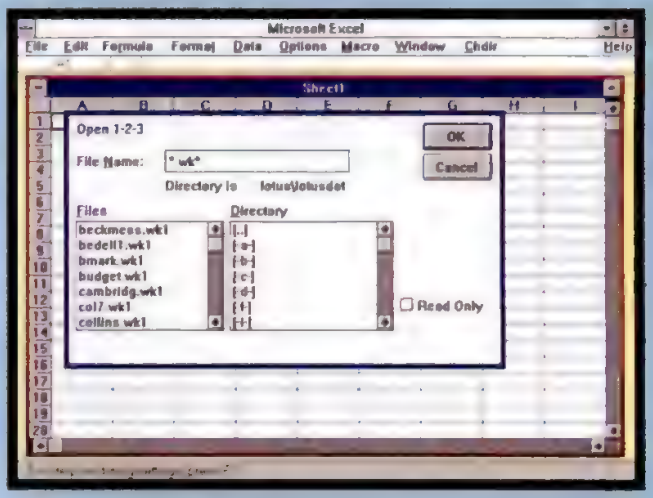
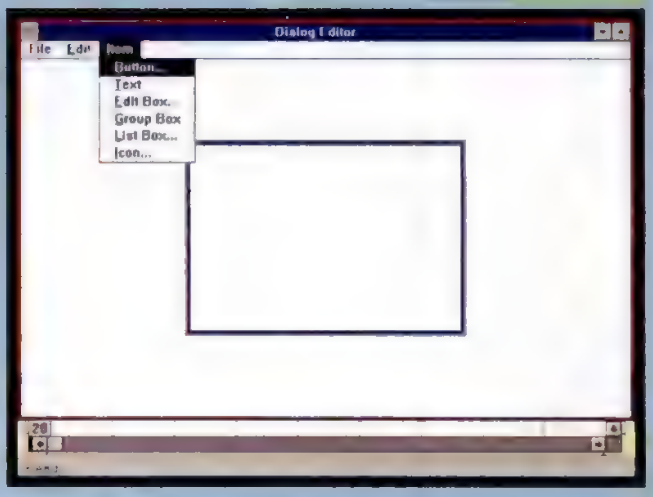


Figure 2: The custom dialog box presented by clicking the new Open 1-2-3 command on the File menu.

Figure 3: *Excel* 2.1's Dialog Editor offers menus and icons that make it easy for you to create custom dialog boxes.



you can size and position it with the mouse or with the Info command on the Edit menu. The Info command also lets you change an element's default text.

Once you've built your dialog box, you simply copy it to the Clipboard (using an Edit-menu command), return to your *Excel* macro sheet, select the upper-left corner of the range in which your macro will be defined, then use *Excel*'s Paste command. *Excel* then automatically translates your work in Dialog Editor into the appropriate numbers and words.

You can also use Dialog Editor to modify an existing custom dialog box. Just select the entire dialog-box definition (B41:H53 in Mr. Elkodsi's example), copy it to the Clipboard, invoke the Dialog Editor, and use the Dialog Editor's Paste command. When you've changed the dialog box as you want, send it back to *Excel* by way of the Clipboard. But be aware that if you add any elements to or remove any elements from an existing dialog box, the size of the definition range will change, and you will need to modify your DIALOG.BOX() statement accordingly.

This macro lets you experiment with *Excel*'s menu-customizing features. Enjoy!

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by
Craig L. Stark

The Working Word

MM/DD/YY IN WORD

To insert the current date in a document, Microsoft recommends that you load the built-in MACRO.GLY after you bring up *Word*. Then call the document, position the cursor at the desired point, and simply type date and press F3. The procedure generates a formal date, in which the name of the month is spelled out.

The trick is very handy, but I often want to insert a date in the less formal MM/DD/YY format. The *Word* 5.0 macro shown in Figure 1 will enable you to do this simply by typing MMDDYY and hitting F3.

John M. Simpson
Eugene, Oregon

- **MM/DD/YY IN WORD:** Insert informal-style dates into documents with this handy macro.
- **EDITING WORD MACROS:** Here's a handy way to edit and save macros, plus a pair of macros for shelling out to DOS and printing the current page.

Although Mr. Simpson's macro is relatively straightforward, I would like to note a few elements of the code. To begin with, the first line,

```
o<down 9>m<enter>
```

merely confirms the choice of a civilian (MDY) date format. You can speed up the macro if you omit this line, and you won't need it if you have already set the correct format with the Options menu. Furthermore, the asterisk that appears at the beginning of the macro's second line simply provides a search target for moving the cursor prior to deleting the "full style" name of the month. Finally, if you're new to creating *Word* macros, you should note that this one must be written rather than recorded, because of its multiple `if` instructions.

MMDDYY.MAC — **COMPLETE LISTING**

```
«comments»
Macroname   : mmddyy
Keycode     : none
Description : Inserts current date using mm/dd/yy format.
«endcomment»
<esc>o<down 9>m<enter>
*date<f3><esc>s*<tab>u<enter><del>
<f6><esc>s <tab>d<tab>n<tab>n<enter>
«if selection="January "»<del>01«endif»
«if selection="February "»<del>02«endif»
«if selection="March "»<del>03«endif»
«if selection="April "»<del>04«endif»
«if selection="May "»<del>05«endif»
«if selection="June "»<del>06«endif»
«if selection="July "»<del>07«endif»
«if selection="August "»<del>08«endif»
«if selection="September "»<del>09«endif»
«if selection="October "»<del>10«endif»
«if selection="November "»<del>11«endif»
«if selection="December "»<del>12«endif»
/<f6><esc>s,<enter><left>
«if selection<10»0<f6>«endif»<left>
<esc>r, 19<tab>/<tab>n<tab>n<tab>n<enter><end>
```

Figure 1: Written in *Microsoft Word* 5.0, this macro allows you to insert dates into documents using a mm/dd/yy format.

EDITING WORD MACROS

If you write a lot of macros in *Microsoft Word*, you'll find that the MACRO_LOAD and MACRO_SAVE pair shown in Figure 2 are useful for editing them. Calling MACRO_LOAD (which I've assigned to Ctrl-M) clears a new window (if possible), prompts for the name of a macro, and loads it into the new window. If you don't specify a macro name, MACRO_LOAD lets you create a new macro and then supplies the required header.

Once you edit the macro, you can copy it to a glossary using MACRO_SAVE (assigned here to Ctrl-W). Note, however, that the header

```
<<COMMENT macro_name.mac^<key
 code>>>
```

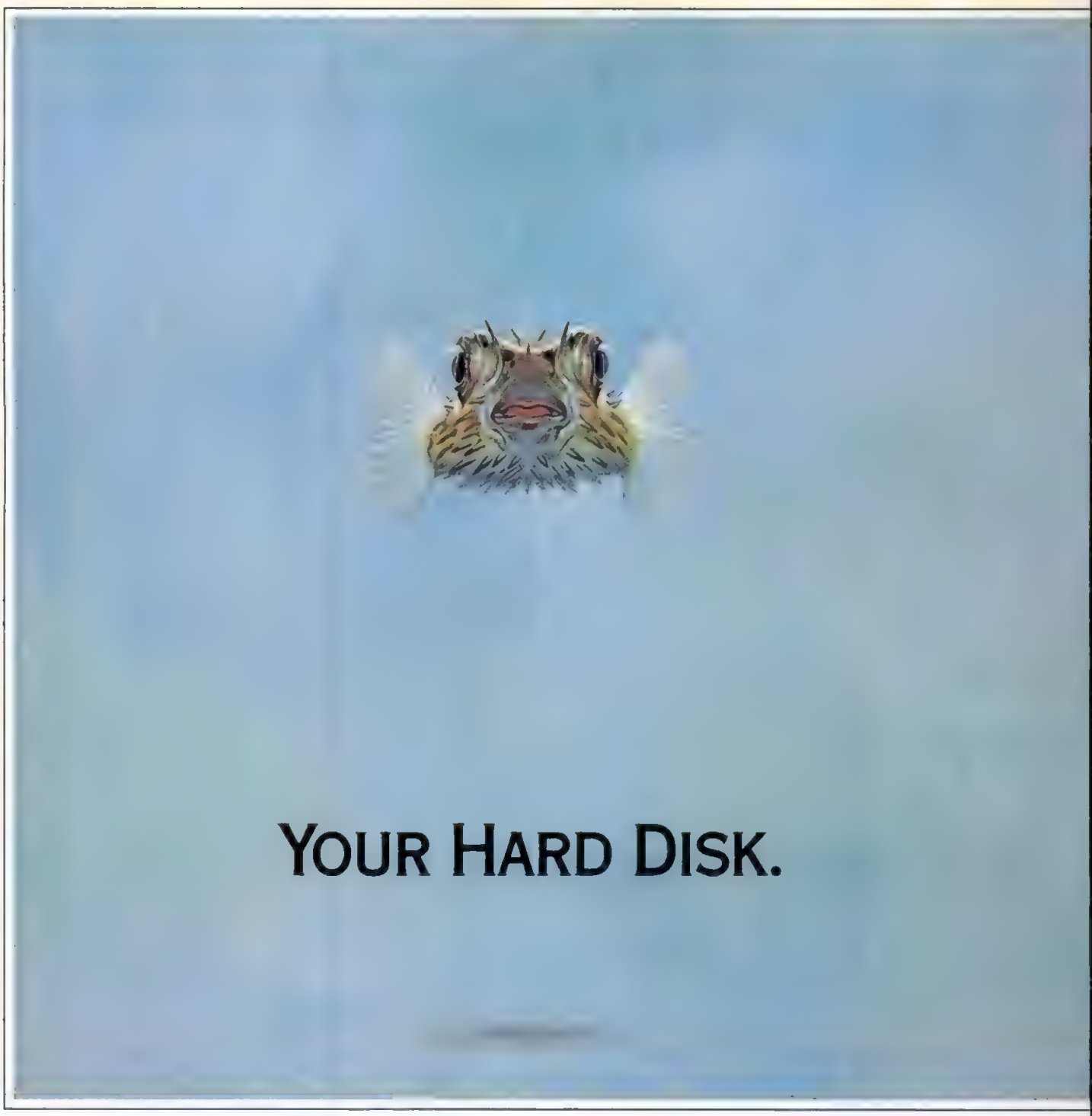
is required by MACRO_SAVE.

For still greater convenience, I recommend that you include these two macros as part of a macro-writing glossary that contains Ctrl and Alt codes written out as glossary entries. With such a glossary, pressing Ctrl-J would insert <ctrl J> into the text of the macro being edited. You could assign other useful fragments, such as <<COMMENT, to function keys.

I've also included two other useful *Word* macros, shown in Figure 3: DOS.MAC (Ctrl-D) shells out to DOS quickly and efficiently, and PRINT_PAGE.MAC (Ctrl-P) prints the current page.

Richard Edwards
Cosmopolis, Washington

The error trapping in Mr. Edwards's MACRO_LOAD and MACRO_SAVE is admirable. He includes several error conditions you may encoun-



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ter and warns you with the appropriate messages. Moreover, the provision of a header for a new macro and the elimination of *Word*'s normal multistep procedure for saving a new or edited macro are blessings.

Mr. Edwards's two supplementary macros address some of my longstanding gripes about cumbersome menu-driven procedures. Normally, you would shell out to DOS by going to the Library and selecting Run. But if you're not a regular *Word* user, this procedure is by no means intuitive. When returning to *Word*, it's not enough to type EXIT and hit Enter; *Word* insists on prompting you to hit still another key just after you've shifted your attention back to your document.

> Use a *Word* glossary to assign macro instructions, like <<COMMENT, to function keys.

Similarly, to print the current page, you must again drop down to the third menu level (printer options), hit the Down Arrow key four times, and then hit the Spacebar (not the Right Arrow) twice to move from All to Pages before you can tell the program to go ahead and print just page one.

If you download these files from PC MagNet, you'll get not only the macros shown in Figures 2 and 3, but four additional ones that aren't printed here. The macros TOGGLE_BORDER.MAC and TOGGLE_STYLE.MAC toggle the window border and style bar on and off; TOGGLE_SHOW.MAC rotates among the three different possibilities for displaying *Word*'s nonprinting characters; and FILE_STAMP.MAC appends a date, time, and file location stamp to the end of your document.

DOS.MAC and PRINT_PAGE.MAC

```
«COmment print_page.mac^<ctrl P>»
«COmment This macro prints the current page»
«SET ECHO="OFF"»
<ctrl esc>jp«set pagenum=field»<ctrl esc>po<down 4>p<tab>«pagenum»
<enter><enter><ctrl esc>po<down 4>a<enter><esc>.


«COmment dos.mac^<ctrl D>»
«set echo="off"»
<ctrl esc>lr\command.com<enter>
```

Figure 3: DOS.MAC and PRINT_PAGE.MAC reduce *Word*'s multistep procedure for shelling out to DOS and printing the current page to single keystrokes.

MACRO_LOAD.MAC and MACRO_SAVE.MAC

```
«COMMENT macro_load.mac^<ctrl M>»
«COMMENT The comment above is used by macro_save.mac»
«SET ECHO="OFF"»
«COMMENT open a window if possible»
«if WINDOW=7»«PAUSE Too many windows open!  Press Enter to quit.»«quit»«endif»
«SET winnum=WINDOW»
«if zoomed=window»<ctrl f1>«endif»
<ctrl esc>wh<right>y<enter>
«COMMENT try a vertical window split if necessary»
«if WINDOW=winnum»
<ctrl esc>wsv<right>y<enter>
«if WINDOW=winnum»«PAUSE Can't split out of this window!  Press Enter to quit.»«quit»«endif»
«endif»
<ctrl f1>
«COMMENT select macro and load it»
<ctrl esc>i<f1>«PAUSE»«set macro=field»<esc>
«macro»^"<f1>
<ctrl pgup>
«COMMENT make header if none exists»
«if selection<>"^s"»
            ^«COMMENT <end><left>.mac<end>"<ctrl ^>"»<left 2>
«endif»


«COMMENT macro_save.mac^<ctrl W>»
«set promptmode="ignore"»
«COMMENT save window number to test if save is successful»
«SET winnum=WINDOW»
«COMMENT select macro name within header»
<ctrl pgup><f8><f8><f6><end><left 2>
«set macro=selection»
«COMMENT save macro»
<shift f10><esc>c«macro»<enter>
<ctrl f1><esc>w<enter>
«COMMENT test if save succeeded»
«if winnum=WINDOW»
            <ctrl pgup><f9><del>«PAUSE Choose different key code!  Press Enter to continue.»«endif»
```

Figure 2: MACRO_LOAD.MAC and MACRO_SAVE.MAC simplify writing and editing your *Word* macros.

CORRECTION

Several readers have been kind enough to draw my attention to an error in this column in our August 1990 issue. It is true, as described, that you can use the *WordPerfect* 5.1 Printer Program to send more than 32 fonts (the default) to your HP LaserJet II printer with the corresponding .PRS driver. However, the *WP* 5.1 driver default of 32 accurately reflects the limit of what the *printer* can access. So although you can load additional fonts, you have nothing to gain.

In checking the reader's procedure, I find I had accidentally duplicated a group of font numbers in my batch-file-loading program, so it appeared that some 35 fonts had been successfully loaded. Moreover, the last ones I loaded printed properly. However, the truth of the matter is that *WordPerfect* overwrote some of the fonts that had been loaded into the printer's memory at an earlier point in the sequence. Thus only 32 fonts were actually accessible at any one time. My apologies for the slip.

TIPS FROM WORKING WORDSMITHS

Tell fellow users about your latest word processing discoveries; we'll pay you $50 for any tips we print. Please send your letter on a disk along with a printout. Mail your contributions to The Working Word, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload them to PC MagNet (see page 8 for access instructions). ■

by
Neil J. Rubenking

User-to-User

BRIGHTER BACKGROUNDS

Since I began using a color monitor, my biggest gripe has been the lack of a *bright* white background screen with black foreground text. After thrashing around, trying to solve the problem application by application, I realized that the gray background (euphemistically called *white*) is a limitation of DOS. Apparently DOS allows only eight background colors, and bright white isn't one of them, though it is allowed as a *foreground* color. Why does this limitation exist, and can it be beat with software or hardware?

James J. Felts
Bellevue, Washington

In text mode, every location on the screen has a character byte and an attribute byte. The character byte controls which of the 256 ASCII characters shows up on the screen, and the attribute byte controls the *color* of that character. Each bit of the byte is significant, as shown in Figure 1. The foreground gets 4 bits, 3 for color and 1 for brightness. The background also gets 3 bits for color, but the fourth bit controls blinking, not brightness. That's why you can't normally get bright background colors.

However, both CGA and monochrome adapters have a control port with a bit that turns blinking on and off. With blinking turned off, the high bit of the attribute byte controls background brightness instead. EGA and VGA adapters don't require you to poke bytes into a port—they offer a BIOS function to disable/enable blinking.

BRIGHT.BAT (Figure 2) is a batch file that creates DEBUG scripts to let you play with bright backgrounds on CGA, monochrome, or EGA/VGA systems. You tell it the monitor type (C, M, or E) on the command line. It creates the script, redirects it into DEBUG, and deletes the script. Then, to show its accomplishment, it writes a line with a bright background to the screen using ANSI commands (if you don't load ANSI.SYS, delete this line). To restore blinking, run BRIGHT with the appropriate monitor type and add any character as a second parameter, BRIGHT E X.

- **BRIGHTER BACKGROUNDS:** Use DEBUG to give yourself 16 different background colors.
- **SHADES OF GRAY:** Switch your VGA output to 64 shades of gray, even on a color monitor.

Figure 3 shows TEST.BAT, a batch file that lets you see all of the 256 color combinations made possible by bright backgrounds. It uses ANSI commands to change colors and position the cursor, so load ANSI.SYS before using it. All ANSI commands begin with an escape character, represented here by ^[. This is *not* a caret followed by a left bracket—it's ASCII character 27, the escape character. When you've created TEST.BAT, run it before and after setting up bright background with

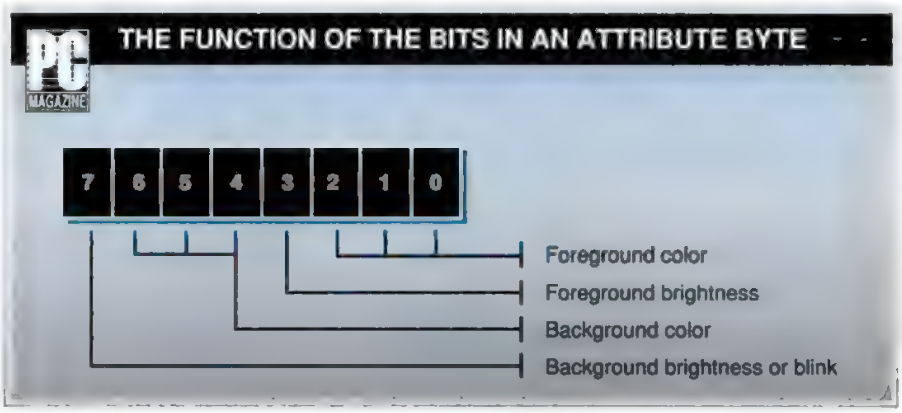

Figure 1: The high bit of the attribute byte controls blinking *or* bright background.

BRIGHT.BAT 1 of 2

```
@ECHO OFF
SET monitor=
IF '%1'==='' GOTO bad
FOR %%v IN (C M E c m e) DO IF %%v==%1 SET monitor=%1
IF '%monitor%'==='' GOTO bad
ECHO A100 > TEMPDBUG.SCR
GOTO label%monitor%
:LabelC (for CGA)
ECHO MOV DX,3D8 >> TEMPDBUG.SCR
GOTO CGAorMono
:labelM (for Monochrome)
ECHO MOV DX,3B8 >> TEMPDBUG.SCR
:CGAorMono (for CGA and Monochrome)
IF '%2'==='' ECHO MOV AL,9 >> TEMPDBUG.SCR
IF NOT '%2'==='' ECHO MOV AL,29 >> TEMPDBUG.SCR
ECHO OUT DX,AL >> TEMPDBUG.SCR
GOTO finish
:LabelE (for EGA)
IF '%2'==='' ECHO MOV BL,0 >> TEMPDBUG.SCR
```

Figure 2: BRIGHT.BAT lets you turn off your monitor's "blink," replacing it with bright backgrounds.

BRIGHT.BAT 2 of 2

```
IF NOT '%2'==''' ECHO MOV BL,1 >> TEMPDBUG.SCR
ECHO MOV AX,1003 >> TEMPDBUG.SCR
ECHO INT 10 >> TEMPDBUG.SCR
:finish (for any monitor)
ECHO RET >> TEMPDBUG.SCR
ECHO. >> TEMPDBUG.SCR
ECHO G >> TEMPDBUG.SCR
ECHO Q >> TEMPDBUG.SCR
DEBUG < TEMPDBUG.SCR > NUL
DEL TEMPDBUG.SCR
REM Delete the next two lines if you don't load ANSI.SYS
IF '%2'==''' ECHO 0;5;7mThis line has a bright background
IF NOT '%2'==''' ECHO 0mBack to normal
GOTO end
:bad
ECHO Call BRIGHT with a command line parameter of C, M, or E,
ECHO C for CGA, M for Monochrome, E for EGA/VGA. To turn
ECHO OFF bright background, add another parameter on the
ECHO command line, e.g. "BRIGHT E X"
:end
SET monitor=
```

TEST.BAT COMPLETE LISTING

```
ECHO OFF
CLS
FOR %%c IN (0 1 2 3 4 5 6 7) DO ECHO 1%%c;26H9A0;3%%c;40mXX18C1mXX
FOR %%c IN (0 1 2 3 4 5 6 7) DO ECHO 1%%c;28H9A0;3%%c;41mXX18C1mXX
FOR %%c IN (0 1 2 3 4 5 6 7) DO ECHO 1%%c;30H9A0;3%%c;42mXX18C1mXX
FOR %%c IN (0 1 2 3 4 5 6 7) DO ECHO 1%%c;32H9A0;3%%c;43mXX18C1mXX
FOR %%c IN (0 1 2 3 4 5 6 7) DO ECHO 1%%c;34H9A0;3%%c;44mXX18C1mXX
FOR %%c IN (0 1 2 3 4 5 6 7) DO ECHO 1%%c;36H9A0;3%%c;45mXX18C1mXX
FOR %%c IN (0 1 2 3 4 5 6 7) DO ECHO 1%%c;38H9A0;3%%c;46mXX18C1mXX
FOR %%c IN (0 1 2 3 4 5 6 7) DO ECHO 1%%c;40H9A0;3%%c;47mXX18C1mXX
REM The second set of lines gives bright background
FOR %%c IN (0 1 2 3 4 5 6 7) DO ECHO 1%%c;26H0;5;3%%c;40mXX18C1mXX
FOR %%c IN (0 1 2 3 4 5 6 7) DO ECHO 1%%c;28H0;5;3%%c;41mXX18C1mXX
FOR %%c IN (0 1 2 3 4 5 6 7) DO ECHO 1%%c;30H0;5;3%%c;42mXX18C1mXX
FOR %%c IN (0 1 2 3 4 5 6 7) DO ECHO 1%%c;32H0;5;3%%c;43mXX18C1mXX
FOR %%c IN (0 1 2 3 4 5 6 7) DO ECHO 1%%c;34H0;5;3%%c;44mXX18C1mXX
FOR %%c IN (0 1 2 3 4 5 6 7) DO ECHO 1%%c;36H0;5;3%%c;45mXX18C1mXX
FOR %%c IN (0 1 2 3 4 5 6 7) DO ECHO 1%%c;38H0;5;3%%c;46mXX18C1mXX
FOR %%c IN (0 1 2 3 4 5 6 7) DO ECHO 1%%c;40H0;5;3%%c;47mXX18C1mXX
PAUSE > NUL
ECHO 0m
```

Figure 3: To see all 256 color combinations, run TEST.BAT after running BRIGHT.

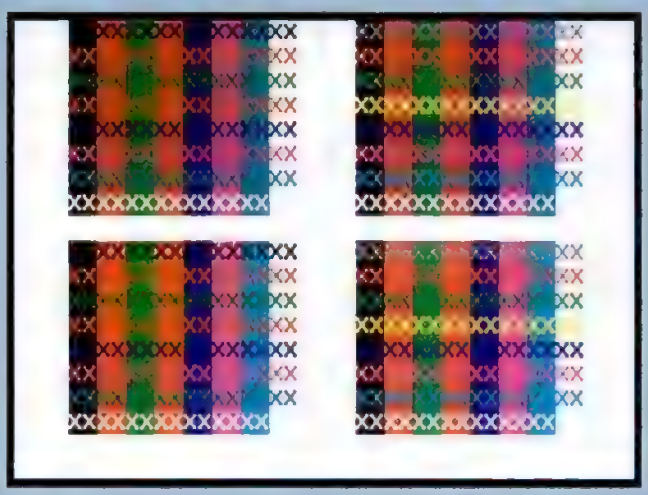

Figure 4: If you run BRIGHT.BAT followed by TEST.BAT, you'll see this screen with all of the 256 possible foreground and background combinations.

BRIGHT to see exactly what BRIGHT does. Figure 4 is a screenshot of TEST .BAT's output.

SHADES OF GRAY

The DEBUG script shown in Figure 5 creates a program that tricks an MCGA/VGA into thinking it's attached to a black-and-white monitor. This has the effect of limiting *all* output to 64 shades of gray. The program will even make *Microsoft Windows* turn black and white!

Here's what it does. The program calls the VGA BIOS with a function that turns the gray-scale summing bit on or off. Then it reads the video mode and sets it to the current mode, because this function takes effect only after a video mode set.

Scott Taylor
Berthoud, Colorado

VGA users usually want *more* color, not less, but there are times when gray-scaling is useful. For example, if you're going to photograph a screen in black and white, you'll get a better idea of the result if you gray-scale the image first. The tiny programs GSON .COM and GSOFF.COM give you that option. GSON turns gray-scale summing on—all colors are converted to corresponding shades of gray. GSOFF turns it off again. An example of this is shown in Figure 6.

The single DEBUG script GSON OFF.SCR creates both programs—they differ only by 2 bytes. Type the script using a pure ASCII editor, and don't omit the blank lines before the two lines that begin with N. Then give the command

```
DEBUG < GSONOFF.SCR
```

If you don't see any ^Error messages, you've created both programs.

In its most colorful mode, the VGA can display 256 different colors on the screen at once. Each of the 256 colors is made of red, green, and blue components. The individual components can take intensity values from 0 to 63, for a total of 262,144 possible colors (64 by 64 by 64).

To convert a color into its gray-scale equivalent, the BIOS adds 59 percent of the green value, 30 percent of the red, and 11 percent of the blue. These percentages reflect the relative brightness of the pure colors green, red, and blue. The result is a number from 0 to 63, and the BIOS sets each of the three colors to this value, producing a shade of gray.

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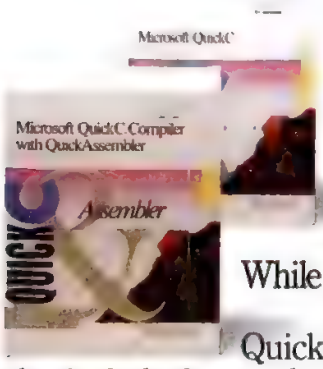

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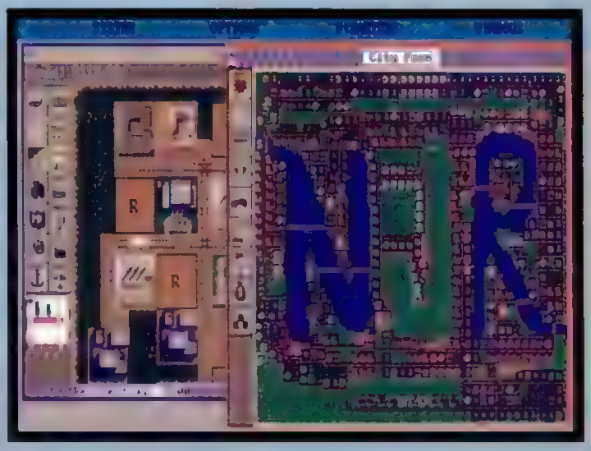
GSONOFF.SCR — **COMPLETE LISTING**

```
A 100
MOV  AX,1200        ;Enable grayscale summing
MOV  BL,33
INT  10
MOV  AH,0F          ;Get video mode
INT  10
MOV  AH,00          ;Set video mode (to the same mode)
INT  10
MOV  AX,4C00        ;Terminate program
INT  21

N GSON.COM
R CX
14
W
A 100
MOV  AX,1201        ;Disable grayscale summing

N GSOFF.COM
W
Q
```

Figure 5: This DEBUG script produces two tiny programs that turn gray-scaling on and off.



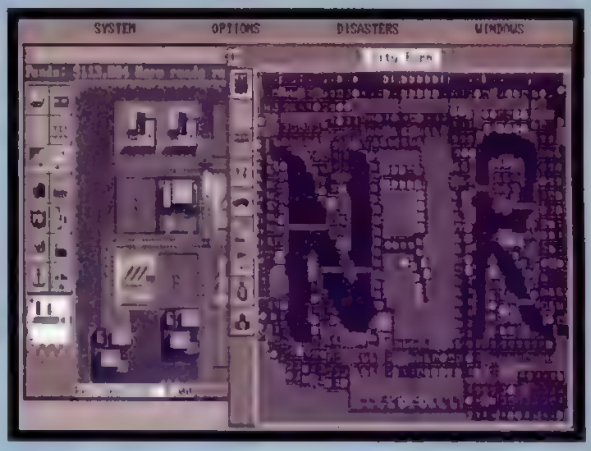


Figure 6: The top picture shows a VGA screen in full color. The one on the bottom shows the same screen after turning gray-scale summing on with GSON.COM. You can easily turn it off again with GSOFF.COM. The script shown in Figure 5 creates both of these handy little programs.

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by
Jeff Prosise

Tutor

UNDERSTANDING HIMEM.SYS

What's the purpose of the HIMEM.SYS driver that comes with *Windows* 3.0, and how do you use it? Does it somehow enable you to move TSRs and device drivers into high memory under DOS?

E. I. Muehldorf
Potomac, Maryland

■ UNDERSTANDING HIMEM.SYS: Here's how Microsoft's XMS driver enables access to memory above 640K.

Remember the discussion of extended memory and the Extended Memory Specification (XMS) that appeared in the December 26, 1989, Tutor column? HIMEM.SYS is Microsoft's version of the XMS driver. *Windows* 3.0 uses it to access extended memory in a well-behaved manner that's compatible with other extended memory-aware programs, yet not necessarily with EMS-handlers.

Because HIMEM.SYS is present, you could conceivably run other XMS processes concurrently with *Windows* in memory, without putting either *Windows* or the other programs at risk.

HIMEM.SYS marshals access to extended memory (or, to be more specific, *all* memory above 640K) the same way EMS drivers control expanded memory: it provides a set of functions for programs to access via far calls to the driver's entry point. You obtain the entry point by executing an interrupt 2Fh with AX set to 4310h; the 32-bit address of the driver's entry point is returned in ES:BX. These control functions, which are summarized in Figure 1, enable programs to allocate blocks of memory, move data in and out of them, and release them when they're no longer needed. To understand the functions, you need to know that HIMEM.SYS recognizes three types of memory blocks:

- Upper Memory Blocks, or UMBs, which lie at addresses between 640K and 1MB.
- The High Memory Area, or HMA, the first 64K of memory (minus 16 bytes) beyond 1MB.
- Extended Memory Blocks, or EMBs, which may lie anywhere in extended memory above the HMA.

The Upper Memory area, between 640K and 1MB, is reserved for use by the system's video display and BIOS, but chunks of it normally remain unused. HIMEM.SYS relies on other utilities, known as UMB providers, to create Upper Memory Blocks for backfilling these unused regions of memory. When these blocks are present, they can be accessed in real mode, since they fall within the real-mode addressing limits of the 80x86 family.

Functions 10h and 11h arbitrate accesses to UMBs so that two processes contending for the same block won't destroy each other by overwriting what the other placed there. Function 10h allocates a block; function 11h releases it. While a block is allocated to a program, it is protected from other applications that abide by XMS protocols, because the driver will not allocate the same block to two programs.

HIMEM.SYS carves Extended Memory Blocks out of the region of extended memory above the 1,088K mark (1,024K plus the 64K occupied by the HMA). Functions 08h through 0Fh govern access

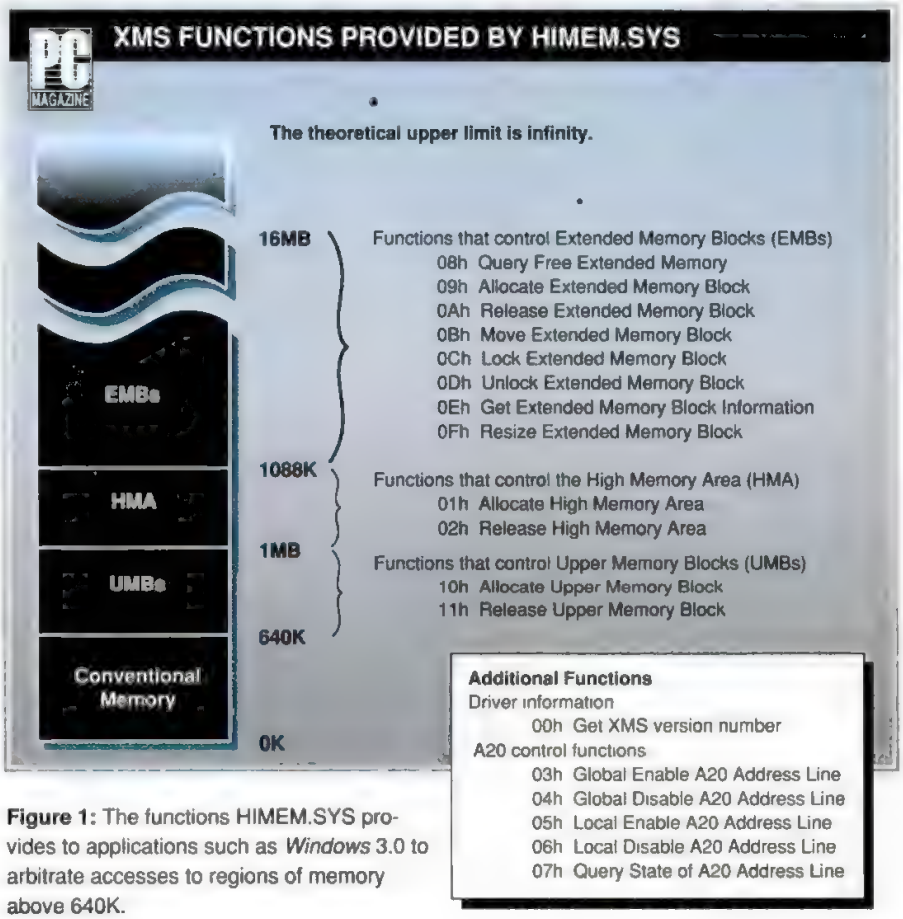

Figure 1: The functions HIMEM.SYS provides to applications such as *Windows* 3.0 to arbitrate accesses to regions of memory above 640K.

to these blocks. For example, function 0Bh, Move Extended Memory Block, moves data from conventional memory to an EMB, from an EMB to conventional memory, or between two EMBs. A program may also access extended memory directly by calling function 0Ch to obtain a 32-bit linear address for the EMB, simultaneously locking its location in memory. Function 0Dh is the counterpart to 0Ch, used to unlock a previously locked block.

HIMEM.SYS also provides hardware-independent control over the A20 address line, which allows processes running on 286s, 386s, and 486s to access the first 64K of extended memory (the HMA) in real mode.

The High Memory Area is set apart from the rest of extended memory because of a design quirk that allows 286s and 386s to access it in real mode. The secret? Selectively enabling the A20 address line so that a 21-bit memory address can be formed. Recall that 8088s and 8086s have 20 address lines (numbered A0 through A19) that allow them to access up to 1MB of RAM. The 80286 and above have more address lines for reaching higher into memory. The extras are normally disabled in real mode so that the CPU behaves just like an 8088. You could try to access more than just 1MB by loading the address FFFF:FFFF into a segment:offset pair, but lacking the hardware to do it, the CPU would simply wrap around to the bottom of memory and interpret the address as 0000:FFEF.

But with A20 enabled, the resultant address won't wrap around at all. Instead, it will reach beyond the 1MB mark and allow the CPU to access as much of the next 1MB of extended memory as a 16-bit offset register will allow: another 64K, or the region known as the HMA. Why is this important? For one, the switch from real mode to protected mode and back normally required to gain admittance to extended memory is time-consuming, particularly on 286 machines, which must be reset through the keyboard controller (a process that can require up to several milliseconds, an eternity to a computer). Moreover, even a temporary switch to protected mode has wider-ranging implications. A program can't handle normal hardware interrupts when it switches to protected mode, so the interrupts must be disabled during such time. However, this means that your program may miss certain interrupts if it flips into protected mode and back, so avoid this.

The A20 line provides a bit of relief from the confines of real mode's 1MB cap on memory, and the XMS driver's arbitration of the A20 line ensures that two XMS-aware programs contending for it won't interfere with each other.

HIMEM.SYS provides five functions, numbered 03h through 07h, for dealing with the A20 line. *Global* enable/disable is to be used by programs that have requested and been allocated the HMA. *Local* enable/disable is for programs that do not own the HMA. It is each program's responsibility to enable the A20 line before it accesses the HMA and to restore the original state of the line (which is obtainable with function 07h) after it's done.

You install HIMEM.SYS with a DEVICE= command in the CONFIG.SYS file. It takes two parameters:

> The A20 line provides a bit of relief from the confines of real mode's 1MB cap on memory.

- /HMAMIN = *n*, which specifies the minimum amount of memory (in kilobytes) a program may request in the High Memory Area. The range of valid values is 0 to 63; the default is 0.
- /NUMHANDLES = *n*, which specifies the maximum number of extended memory block handles that may be allocated in the system at any one time. The range of valid values is 0 to 128; the default is 32.

HMAMIN helps you make the most efficient use of the HMA. Slightly less than 64K long, the HMA can only be allocated as a unit; it cannot be divvied up into smaller chunks as the rest of extended memory can. If a program needing 4K of memory in the HMA requests it before a program needing 40K, the second program's request will be denied access unless HMAMIN is set to 5 or greater. If you know in advance how much of the HMA certain programs are going to ask for, you can enforce judicious use of it by tweaking HMAMIN accordingly.

NUMHANDLES, the second parameter, specifies how many EMB handles HIMEM.SYS should reserve room for internally. Each additional handle requires 6 bytes of conventional memory. As a rough rule of thumb, set aside space for 16 handles per megabyte of extended memory in your system. Then all of extended memory can be put to use in chunks as small as 64K.

Both HMAMIN and NUMHANDLES are defined in Version 2.0 of the XMS specification, dated August 23, 1988. The version of HIMEM.SYS shipped with *Windows* 3.0 accepts two additional switches on the DEVICE= line: /SHADOW:ON|OFF and /MACHINE:NAME.

Many PCs provide a feature known as *ROM shadowing*, where ROM, which is notoriously slow, is copied to RAM and its code is executed from there for increased speed. By default, HIMEM.SYS attempts to disable ROM shadowing on these PCs to free additional extended memory. The /SHADOW switch lets you explicitly instruct HIMEM.SYS to enable or disable shadowing. This switch is useless on some systems: Many hardware configurations do not permit shadowing to be turned on and off under software control.

The /MACHINE switch is a means of adapting HIMEM.SYS to the peculiarities of certain systems. At present, the only name it accepts is `acer1100`, which tells HIMEM.SYS it's running on an Acer 1100 PC.

Can HIMEM.SYS be used to load TSRs and device drivers into high memory? No—at least not by itself. The XMS specification does not provide control functions like those used by programs such as *386MAX* and *QEMM386* to stuff programs into high memory. The best way to get programs out of conventional memory is still a 386 memory manager or, on 286s with expanded memory, a utility similar to Quarterdeck Systems' *QRAM*.

ASK THE TUTOR

The Tutor solves practical problems and explains techniques for using your hardware and software more productively. To have your questions answered, write to Tutor, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload them to PC MagNet (see page 8 for access instructions). We're sorry, but we're unable to answer questions individually. ■

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Buyers seeking computers for use in homes (including offices at home) should shop for computers and peripherals which have been Class B certified. These devices carry a label with an FCC ID number. Both new and used Class A verified devices may be sold only for use in commercial and industrial locations. Signals from computers are more likely to be masked by electrical noise from other equipment in such an environment. These areas are also likely to have fewer radios and TVs. Accordingly, equipment marketed only for use in these locations may meet the less rigorous Class A standard. Class B certified equipment may be marketed for use in residences as well as commercial and industrial locations.

As you shop for a computer for use in your home, look for the FCC classification in the specifications or ask your vendor to recommend only machines that have been certified to the Class B limits. TV viewers and radio listeners in your home and in neighboring homes will be glad you did.

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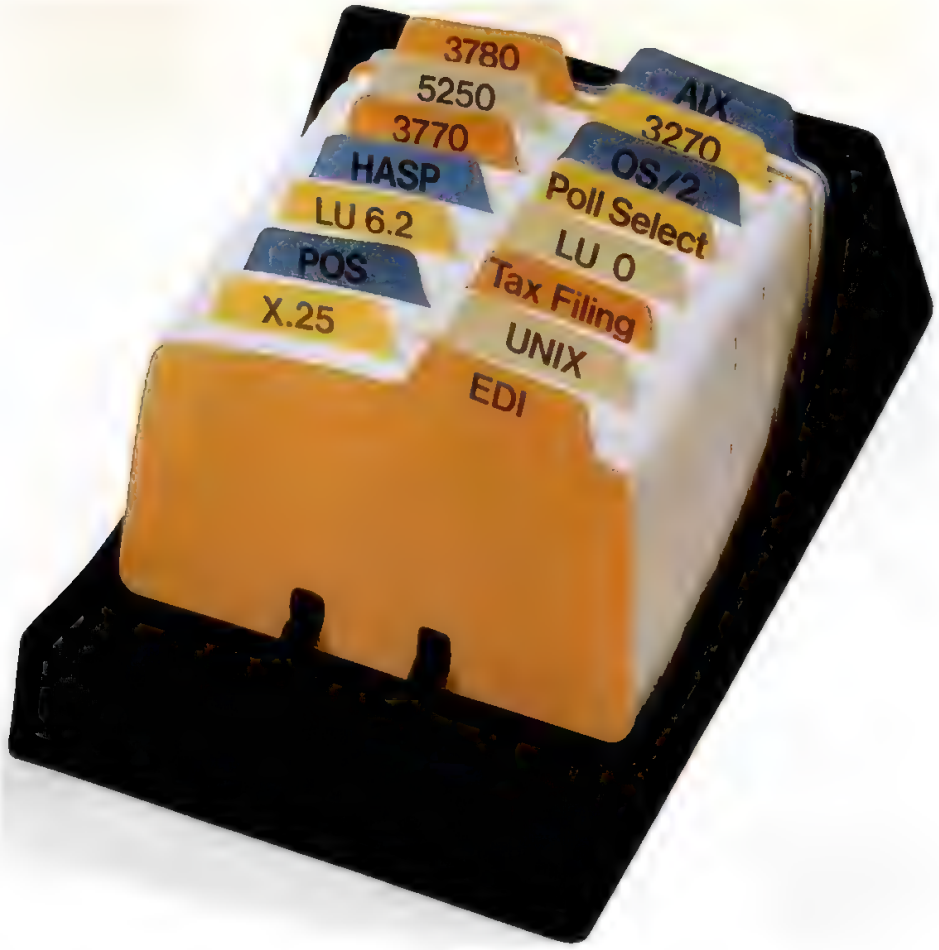

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- **REMOTE JOB ENTRY**—CQ Computer Communications; Serengeti Software; Eastham Assoc.; Sterling Software; Barr Systems; NSA; Black Box; Cleo
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by
Frank J. Derfler, Jr.

Connectivity

- EXTENDING PARALLEL PRINTER CABLES: Here's how to overcome the distance limitations on parallel cables.
- CHOOSING A NETWORK TOPOLOGY: Unless your network is very large, it usually makes sense to select Ethernet or ARCnet rather than Token-Ring.
- PROGRAMMING A PBX: Custom phone features and more processing power will result from the Open Application Interface.
- FORGING A NEW LINK: The new Multiuser DOS Federation will set standards for multiuser systems.

EXTENDING PARALLEL PRINTER CABLES

We keep our network's server in a closet for security purposes, but this puts the attached printers in a poor location for the users. I know we can establish another print server, but that takes the resources of another PC. Isn't there any way to extend the parallel printer cable more than 15 or 20 feet?

Bruce Whitmore
Los Angeles, California

The limitation on parallel printer cable length frustrates many LAN planners. However, several companies sell parallel cable extension devices. Black Box (412-746-5530) offers its Parallel Extender II, which provides a 1,000-foot telephone-wire connection between a print server and a printer, for $275 each—you need one at each end.

However, note that such devices convert parallel signals to serial and then back to parallel again, using simple circuitry. Speed has always been the advantage of the parallel cabling, and slowness the disadvantage of a serial alternative. As devices like this convert the parallel river of data to a serial stream, the print server waits and print jobs back up. While the print server waits, some of its CPU power is spent managing the print queue rather than processing requests for disk access. You'll only be happy with cable extension products that do pure hardware conversion of serial-to-parallel signaling if you have a light printing load.

A more robust alternative comes from Protec MicroSystems (514-631-2811). Its Xtendplus is a microprocessor-controlled device that can contain up to 4 megabytes of print-job storage. It also converts the parallel signals to serial, drives them over as much as 8,000 feet of telephone wire, and then converts them back again, so the output isn't as fast as a parallel cable connection, but the built-in buffer helps to unload the print server faster. The Xtendplus carries an $890 price tag, and you still need two of them, but they'll let you move a printer over a mile away without bogging down your print server.

CHOOSING A NETWORK TOPOLOGY

I'm about to become the administrator of a LAN utilizing Token-Ring wiring. The purchasing decision for our network was made before my involvement. I get the impression that you strongly prefer both Ethernet and ARCnet over Token-Ring. If so, why?

Layne Ricketts
Blacksburg, Virginia

If you've got Token-Ring now, my advice is this: learn to love it. The expense of the Token-Ring wiring and equipment is one of my major complaints. I caution against using unshielded twisted-pair wiring on Token-Ring, because I think it eventually falls prey to poor signal quality, and the effect of this accumulates more on Token-Ring than it does on Ethernet or ARCnet.

Certainly, once the industry gets the chip and software problems straightened out, the 16-megabit-per-second Token-Ring should work very well on enterprisewide networks with many hundreds of nodes. You can't argue with the concept of a network using an orderly token access scheme with 16-megabit-per-second signaling for heavy-duty work, but you may well ask, "Does our organization really need all this?" I can't see any good reason for installing 4-megabit-per-second Token-Ring at this time.

Since you've already inherited a Token-Ring network, I advise you to go to the wiring closets and look at your Token-Ring wiring hubs or, as IBM calls them, Multistation Access Units (MAUs). If your MAUs don't include a capability for remote activity monitoring and the ability to disconnect a node remotely, put some money in the budget for replacements. Proteon, Thomas-Conrad, and other companies offer Token-Ring wiring systems with remote monitoring and management capabilities.

Anyone who hasn't yet chosen a network topology and who doesn't need the robust capability of 16-megabit-per-second Token-Ring should consider the many wiring options available under the IEEE 802.3 (Ethernet) specifications. Companies such as SynOptics can certainly make you happy with the coaxial, twisted-pair, and fiber cable wiring combinations they offer.

However, our LAN Labs testing has discovered that top-flight servers with very fast hard disk arrays and operating systems like *NetWare 386* and *LAN Manager* 2.0 can deliver more data than a single Ethernet cable can carry away. The simple answer is to use two, three, four, or more adapters in the server with separate cable runs for each adapter.

ARCnet, despite its 2.5-megabit-per-

second signaling scheme, is still a favorite of ours. You can't really find fault with something that's simple to install and works well. Competition has reduced the price of ARCnet adapters to under $100, and you still have twisted-pair, fiber, and coaxial cable options. To enhance performance for heavily populated networks, the solution is, again, to use multiple adapters in the servers.

The bottom line is this: if you have a network of fewer than 200 users and those users run common office applications, then select from among ARCnet and Ethernet options on the basis of price and the amount of trust you have in the installer. If you have a large network environment where people move lots of data, including, for instance, files of graphic images, then add 16 megabit-per-second Token-Ring to your option list.

PROGRAMMING A PBX

I know that our PBX telephone system has a microcomputer at its heart. When a repairman opened the cabinet, I saw what appeared to be a PC AT clone sitting in a rack. Can we program this PC to add new features to our telephones?

Muriel Fullam
New York, New York

Organizations consisting of more than three or four people usually have one of three types of phone systems: a key system (every phone has a row of buttons along the bottom), Centrex (the service comes from the telephone company's local office), or a Private Branch Exchange (PBX). You'll usually see a PBX as a cabinet in a dark closet full of telephone wires.

A CPU of some kind, usually an Intel 80286 or 80386, drives every modern PBX. Some have multiple processors. However, practically none of these CPUs run DOS and only a few run something close to Unix. Until late 1989, there was no way the owner or lessee of a PBX could get at the CPU's processing power to customize its operation.

However, in 1989 the industry began opening windows into PBX programming and interaction through the introduction of the Open Application Interface (OAI). This interface gives programmers a standard way to send detailed instructions to and receive responses from the processor(s) in a PBX. Some PBX companies, like Northern Telecom and AT&T, have developed partnerships in the computer industry with such companies as Digital Equipment Corp., Hewlett-Packard Co., and IBM Corp. in order to implement software that meets the OAI standards. Other PBX companies, such as InteCom, NEC, and Henriksen Data Systems, offer VAR toolkits and are openly working with software developers.

Being able to customize your PBX is an interesting option, but the real value of OAI lies in the potential interaction of the relatively low-power processors in the PBX with the processing power that is available on a LAN. Computers on the LAN can work with the PBX to route and reply to calls, store millions of numbers, track calls, and provide special services for each telephone user.

If you can think of great applications for the PBX-to-LAN link, you'll be interested in a document called the Open Application Interface Special Report. It sells for $279 from the Telecom Library (800-LIBRARY). This is a hot area for creative software developers.

> If you aren't familiar with multiuser DOS products that let you share the power of a single 386 or 486 PC, you just might be missing a valuable alternative to a more expensive media-shared LAN.

FORGING A NEW LINK

At the Spring Comdex 1990, the PC LAN Labs sponsored a meeting of companies involved in the multiuser DOS business. We felt that the companies in this interesting market segment needed to quit sparring with each other and begin cooperating enough to set some standards for interoperability. We used the neutral PC LAN Labs banner as a backdrop for this meeting of companies, which are usually highly competitive.

If you aren't familiar with multiuser DOS products, you might be missing a valuable alternative to a more expensive media-shared LAN. These products include operating systems such as *VM/386 MultiUser*, *PC-MOS/386*, *Concurrent DOS 386*, *386/Multiware*, *Quick Connect/386*, and *THEOS DOS* as well as a variety of monochrome and color monitors. (See "Building Workgroup Solutions: Multiuser Graphics Terminals" in the August 1990 issue of *PC Magazine* for more on these alternatives.) Together, these software and hardware products will let you share the power of a single 386 or 486 PC among as many as five users while continuing to run the familiar DOS programs you probably already own—including CAD, database, accounting, and almost all standard PC applications.

Multiuser DOS systems offer some important advantages, such as a very low cost per user and good security. But the companies selling these products use different addressing schemes for multiport RS-232C adapters, different calls for network services, and different methods of implementing graphics. These differences don't make one product better than any other, all they do is fill potential buyers and application developers with a great deal of confusion and concern.

The meeting we sponsored at Comdex was a success, and the Multiuser DOS Federation is the result. The primary goals of this Federation are to set standards for multiuser systems using DOS applications and to help people understand the value of this LAN alternative. If you'd like more information on the Federation and its activities, contact The Software Link at (404) 448-5465.

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03. ☐ Manufacturer—Other
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05. ☐ Computer Consultant
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07 ☐ Communications
08 ☐ Finance/Banking/Insurance/Real Estate/Accounting
09. ☐ Education
10. ☐ Government—Federal
11. ☐ Government—Non-Federal
12. ☐ Research and Development
13. ☐ Data Processing/Computer Service
14. ☐ Health/Medical/Legal Service
15. ☐ Engineering/Architecture
16. ☐ Agriculture/Construction/Mining/Oil/Transportation/Utilities
17. ☐ Non-Computer Retailer/Distributor
18 ☐ Other Business or Service
99. ☐ Other

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03. ☐ Communications
04. ☐ Engineering
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12. ☐ Marketing/Sales
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14. ☐ Admin./Mgmt.
99 ☐ Other

4. Is your company a reseller?
01. ☐ Yes
02. ☐ No

5. For how many IBM PCs and compatibles do you specify brands of products:
01 10 or less
02 11-25
03 26-99
04 100 or more

6. Are there any PCs in your office? (Check all that apply.)
01 ☐ Linked to mainframe
02 ☐ Linked to mini
03. ☐ Networked together

7. Please check the equipment currently installed at your location: (Check all that apply.)
01. ☐ IBM or Compatible PCs
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04 ☐ Macintosh

8. Do you plan to buy any PC Products?
01 ☐ Now
02 ☐ In 4 to 6 months
03 ☐ In 7 to 12 months
04 ☐ No definite plans

9. Number of Employees in your entire company:
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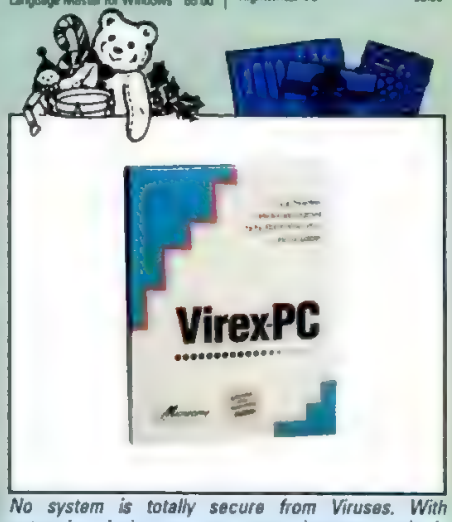

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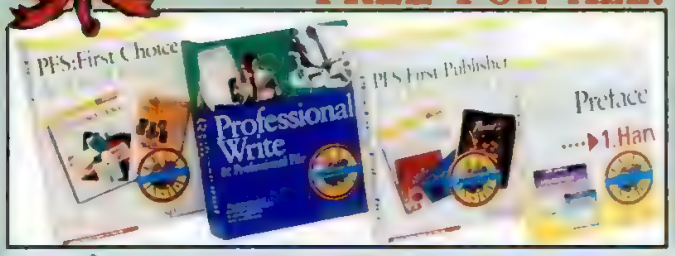

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1-800-441-FAST

FastData 386/SX

$1599

Combine the benefits of an advanced Intel 386 processor, the value of a 286 and the advantages of FastData and you've got the FastData 386/SX! This machine is the choice of those who want to run today's powerful 386 and multitasking software, like Windows, and want to rip through their favorite programs, like Lotus and WordPerfect at blinding speeds. This machine is ideal to run the latest memory demanding and graphic software, right out of the box. We've made our customers' favorite options standard: it comes with an ample two megabytes of memory, a high performance 40mb hard drive, and 16 bit color VGA. Compare performance, features, and service and you will find no better SX value. Interested further? Try the FastData 386/SX for 30 days; you have to be happy - if not, we'll take it back.

System Price	40mb	65mb	80mb	100mb
Monochrome	[illegible]	[illegible]	[illegible]	[illegible]
VGA Color	[illegible]	$1,699	[illegible]	$1,949
VGA 1024	[illegible]	$1,849	$1,999	$2,099

Standard Features

- ✓ 16mhz Intel 80386-SX processor.
- ✓ 2 full megabytes of zero wait-state RAM.
- ✓ 40 mb 28ms IDE hard disk, 1:1 interleave, fast transfer rate.
- ✓ 1.2mb 5.25" or 1.44mb 3.5" floppy drive (2nd drive add $79).
- ✓ Standard chassis with keylock, speed and reset buttons. (Optional chassis add $50)
- ✓ 200 watt power supply
- ✓ Monochrome monitor with monochrome graphic board.
- ✓ Clock calendar, parallel port, and two serial ports.
- ✓ Keytronics 101 key enhanced keyboard.
- ✓ 8 expansion slots and 5 drive bays.
- ✓ Phoenix BIOS.
- ✓ Compatible with DOS, OS/2, Windows, Xenix and Novell.

FastData 386/25

$2299

The optimum combination of features, expandability, and power make the FastData 386/25 an ideal choice for those whose applications demand the most from a computer. Whether running as a network fileserver, CAD or graphics station, or power-user's workhorse, the FastData 386/25 handily meets the challenge. It comes configured with a whopping four megabytes of fast RAM, a superfast 22 millisecond 65 megabyte hard disk, and maximum VGA displaying 1024 by 768 resolution powered by a high-output 16 bit 512K VGA board. Plus, the FastMicro team will configure your FastData 386 exactly the way you want, without sending you shopping elsewhere. When evaluating 386-DX workstations, why even consider anything else?

System Price	65mb	80mb	100mb	200mb
Monochrome	$1,819	$1,969	$2,069	$2,469
VGA Color	$2,149	$2,299	$2,399	$2,799
[illegible]	$2,299	$2,449	$2,549	$2,949

Standard Features

- ✓ 25mhz Intel 80386 processor.
- ✓ 4 megabytes of zero wait-state RAM.
- ✓ 65 mb 22ms RLL hard disk, 1:1 interleave.
- ✓ 1.2mb 5.25" or 1.44mb 3.5" floppy drive (2nd drive add $79)
- ✓ Standard chassis with keylock, and speed and reset buttons. (Optional chassis add $50)
- ✓ Monochrome monitor with monochrome graphic board.
- ✓ 200 watt power supply.
- ✓ Clock calendar, parallel port, and two serial ports.
- ✓ Keytronics 101 key enhanced keyboard.
- ✓ 8 expansion slots and 5 drive bays.
- ✓ Phoenix BIOS.
- ✓ FCC Class B approved.

FastData 286/12

$899

Imagine a fast 286 computer at a super price and you've got the FastData 286/12. This system is complete, not stripped. You get one megabyte of zero-wait-state memory and a 28ms IDE hard disk - standard. Also included is an amber monitor and graphics card, your choice of a high density 1.2mb or 1.44mb floppy drive and a Keytronics keyboard. And since its a FastData, you are backed with toll-free technical support, one year warranty with the FastShip replacement program & on-site service plan, and our 30 day full money back satisfaction guarantee!

System Price	40mb	65mb	80mb	100mb
Monochrome	[illegible]	$999	$1,149	$1,249
VGA Color	$1,229	$1,329	$1,479	$1,579
VGA 1024	$1,379	$1,479	$1,629	$1,729

Standard Features

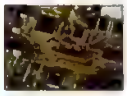
- ✓ 12mhz 80286 processor.
- ✓ 1 megabyte of zero wait-state RAM.
- ✓ 40 mb 28ms hard disk 1:1 interleave.
- ✓ 1.2mb 5.25" or 1.44mb 3.5" floppy drive (2nd drive add $79).
- ✓ Standard chassis with keylock, and speed and reset buttons. (Optional chassis add $50)
- ✓ 8 expansion slots and 5 drive bays.
- ✓ 200 watt power supply.
- ✓ Monochrome monitor with monochrome graphic board.
- ✓ Clock calendar, parallel port, and two serial ports.
- ✓ Keytronics 101 key enhanced keyboard.
- ✓ Phoenix BIOS.
- ✓ FCC Class B approved.

Why FastData?

A personal computer is a large investment, before you choose, we want you to know what to expect when you purchase a FastData personal computer from FastMicro.

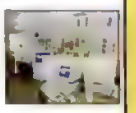
Superior Design

You get more out of your FastData personal computer because we put more into it. We've been building PC's longer than most of the competition and we put that experience to work for you. We use proven designs that pass our stringent performance requirements and compatibility standards so it will be sure to pass yours.



Better Components.

FastData systems use some of the best parts in the industry. For example, each FastData system ships with a Keytronics keyboard. Keytronics costs a lot more than others, but the quality is worth it. Standard equipment includes quality components from Toshiba, Western Digital, Phoenix and other industry leaders.



Selection.

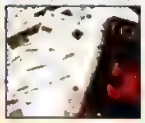
Our face to face retail background has made us never forget that the customer comes first and that a personal computer is just part of a customer's overall needs. That's why FastMicro offers thousands of hardware and software products to enhance your new personal computer. In fact, our competition will probably tell you to call us when you need something to run on their personal computer.

Full Support.

Our team is standing by and ready to make your FastData computer perform to its greatest potential for you. When you buy a FastData computer, you're covered by Toll-Free technical support for life. And since we sell more software than other computer companies, we are uniquely qualified to give the proper support the customer deserves.

Service

All FastData personal computers come with a full one year warranty, but that's just the start. In the unlikely event your computer is down, it is our goal to get it back up and working as quickly as possible - and we back it up with action. Call us toll free and we'll work with you to determine the problem, if a part breaks, we will send you the replacement part through our FastSHIP program - before the broken part is returned to us - and we'll pay the freight both ways. If our phone support or FastSHIP program can't solve your problem, we will service it on-site to most U.S. locations or replace your computer at no charge. Now that's service.



Risk Free.

We pass the test for the choosiest of customers, in fact, FastMicro sells to over half of the Fortune 500 and Universities in 47 states (we're working on the rest). These people hire for a living and rely on us, you can too. You can do more than take our word on it - go ahead and purchase any FastData brand product from FastMicro and if you are not thoroughly satisfied after 30 days, you can return it for a full refund of the purchase price.

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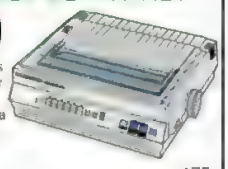
HARDWARE

PRINTERS

ALPS Allegro 500	309
Canon BJ10e *New Portable Printer*	319
Citizen	
200GX	189
GSX140	285
Diconix 150 Plus	329
Fujitsu	
DL3400	419
NEC	
P2200XE	269
P6200	479
P6300	639
Silentwriter II Model 90	1645
Okidata	
182 Turbo	225
320 (IBM)	335
390 (IBM)	469
393 Plus (IBM)	1049

Panasonic KX-P1124

$299



Get multiple fonts and pitches, paper parking, 24 pin letter quality and a 2-year warranty

Panasonic	
KXP1180	175
KXP1191	239
KXP1124	299
KXP1624	369
KXP4420 Laser	829
KXP4450/4455 Lasers	Call
Seiko Smart Label Printer	179
Star	
NX1000-II	149
NX1500	299
NX2410	249
XB2410 / 2415	429 / 569
Texas Instruments Microlaser PS35	1839

MONITORS

Mitsubishi	
1410 EGA	325
Diamond Scan 1381	479
NEC	
Multisync 2a	489
Multisync GS 2a	199
Multisync 3d	629
Multisync 4d	1095
Packard Bell	Call
Panasonic	
C1381 VGA 1024x768	439
Princeton	
Max15	237
Ultrasync 12"	479
Ultrasync 14" (now 1024x768)	509
Ultra 16	835
Samsung	Call
Seiko	
CM1440	519
CM1450	659
Sony 1304 Multiscan	669
Zenith 1492	Call

BOARDS

ATI	
2400 ETC Internal	147
2400 ETC External	187
9600 ETC External V.42bis	499
VGA Basic-16 (640x480)	79
VGA Wonder + 256K	199
VGA Wonder + 512K	239
Brown Wagh Sound Blaster	149
Everex	
1200B Int Modem	55
2400B Int Modem	99
EGA 480 Card	75
RAM3000 16 bit RAM card	75
RAM8000 16 bit RAM card	169
Hercules Graphic Card +	169
Intel	
8087-2	115
287XL *New & Faster!*	199
387-DX25	469
387-DX33	599
387-SX16	299
Logitech Scanman Plus	165
Orchid	
ProDesigner	179
ProDesigner II 512/1mb	279/329
Tiny Turbo 286 8mhz	207
Tiny Turbo Xtra 12mhz	267
Paradise	
Basic VGA - 8 bit	109
VGA 1024 256K	175
VGA 1024 512K	229
Practical Peripherals	
1200B Int Modem	59
2400B Int Modem	125
2400B Int with MNP	169
PM9600SA Ext. V.32/V.42bis	449
Prometheus	
Promodem 1200B Int.	48
Promodem 2400B Int.	98
Promodem 2400G Ext.	149
The Complete PC	
Answering Machine	239
Fax 4800	229
Hand Scanner 400	139
Tiara Networking	
Lancard/A PC (Arcnet)	79
Lancard/E Star 8 (Ethernet)	139
Lancard/E AT (16 bit Ethernet)	249
USRobotics	
2400 Baud Internal	119
2400 Baud External	149
Courier HST 14,400 Ext.	579
Courier HST 14,400 Int.	539
Video 7	
VGA 1024i 256K	209
VGA 1024i 512K	237
Vega VGA	149
V RAM VGA 512K	355
Western Digital Controllers	
WD1006V-MM2 MFM AT 1:1	89
WD1006V-SR2 RRL AT 1:1	99
WE1007V-SE2 ESDI AT 1:1	169

POWER PROTECTION

Curtis Ruby Plus	59
Curtis Command Center	85
Datashield 100	57
Datashield ST450 UPS (450VA)	319
Masterpiece Plus	95

FastData Products

FastData Monitors are your best value for the money. We have a complete line made for us by famous manufacturers like Samsung & GoldStar. Like all FastData branded product, you have a full 30 day money-back satisfaction guarantee.

FastData Monitors	
12" Amber Monochrome	79
14" Amber Monochrome	119
14" White Monochrome	119
14" White VGA Monochrome	129
14" CGA Color .52 dot pitch	199
14" EGA Color .39 dot pitch	319
14" VGA Color .31 dot pitch	319
14" VGA 1024 x 768i .28 dp.	399

FastData Boards	
16 Bit VGA 256K	99
16 Bit VGA 512K	129
2400B Int Modem w/ software	69
9600B SendFax w/ 2400B Modem	99
CGA or MGP Card	35
Parallel/Dual Serial/Game Card	35
XT 1.44 Dual Floppy Controller	35

FastData 16-Bit VGA $99

The *FastData* VGA card does CGA, EGA and VGA up to 1024x768. Its expandable to 512K & has a 30 day money-back satisfaction guarantee.

DISK DRIVES

Colorado 40-120mb Int. Tape	249
Conner IDE drives	Best Price
Miniscribe	Call
Mitsubishi	
64MB AT RLL MR535	269
64MB AT RLL Kit w/ controller	349
Seagate	
20MB XT Kit #225	239
30MB XT Kit #238	249
40MB AT #251-1	299
80MB SCSI #296N	389

Toshiba	
360K Floppy	69
720K 3.5" Floppy	69
1.2MB 5.25" Floppy	79
100mb MK234 IDE 25ms	529

Toshiba 1.44 3.5" Floppy Drive $79

This drive formats and reads 720K and 1.44mb formats. Kit includes brackets and black and grey faceplates. Rails add $5

SOFTWARE

DATABASE

Clarion Personal Developer	45
Clarion Prof. Developer	449
Clipper 5.0	459
DataEase	459
dBase III+	439
dBase IV	479
dBXL Diamond	129
Foxbase Plus	177
FoxPro	417
Paradox 3.5	459
Q & A	214
Personal Rbase	Call
RapidFile	99
Rbase for DOS	447
Reflex	159

Postscript Cartridge by Adobe $239

Upgrade your HP LaserJet II to Postscript by Adobe! Comes standard with a full 35 outline fonts and works with normal postscript software. Add even more fonts with Type Cartridges 1 & 2 priced at $229 each

DESKTOP PUBLISHING & GRAPHICS

Autosketch 3.0	139
Corel Draw for Windows	309
Design Cad 3-D	185
DrawPerfect	265
Freelance Plus	307
GEM Desktop Pub.	159
Generic Cadd Level 2 Starter Kit	109
Generic Cadd 5.0	Call
Harvard Graphics	275
Logitech Finesse w/ Mouse	109
Printshop	33
Pagemaker for Windows	479
PC Paintbrush IV Plus	109
Perspective Jr.	69
PFS:First Publisher	89
Publish It!	104
Ventura Gold for Windows	519

FINANCIAL

ACCPAC BPI (per module)	227
Bedford Integrated Acct.	145
DAC Accounting 4.1	79
DAC Bonus Pack 4.1	119
Dollars & Sense	Call
Managing Your Money	113
Peachtree Complete III	139
Peachtree with Data Query	209
Quicken	35
Wealth Builder	129

INTEGRATED

First Choice	99
SmartWare II	417
Symphony Plus	449
LotusWorks	89
Windows 3.0	89
Works	89

MICE

Keytronics Professional Mouse	65
Logitech HiRes C9 Serial Mouse	65
Logitech Serial Mouse w/ Windows	127
Logitech HiRes C9 Bus Mouse	76
Logitech Trackman Serial	75
Microsoft Serial or Bus Mouse only	83
Microsoft Serial or Bus Mouse w/ paint	95
Microsoft Mouse with Windows	147

LOGITECH Hi-Res Mouse

$65 C-9 Serial Ver. Our best mouse-includes Pop-Up Dos & LogiMenu. Add $15 for PaintShow

PROGRAMMING

Macro Assembler	89
Microsoft C 6.0	303
Turbo C++	Call
Turbo Pascal	90
Quick Basic	60
Quick C	60
Quick Pascal	60

SPREADSHEETS

Allways	106
Excel	309
Lotus 1-2-3 version 2.2	325
Lotus 1-2-3 version 3.1	Call
Lucid 3-D	53
Supercalc 5	289
Quattro Pro (call for details)	89

Call On Non-Listed Items

Windows 3.0

$89 This hot graphical environment runs even non Windows software and breaks the 640K barrier. Buy Windows from FastMicro and we'll throw in 12 Windows shareware applications for free! Requires a 286 or above.

FREE BONUS!

WINDOWS SOFTWARE

Adobe Illustrator (Graphics)	279
Adobe Type Manager	55
Ami (Word Processing)	115
Ami Professional (Word Processing)	287
Asymetrix Toolbook	279
Corel Draw (Graphics)	309
DBfast/Windows (Database)	189
Excel (Spreadsheet)	309
Grammatik IV for Windows (WP)	49
Pagemaker (Publishing)	479
Per Form Pro (Forms Management)	259
Micrographix Designer (Graphics)	459
Micrographix Draw Plus (Graphics)	149
Microsoft Mouse w/ Windows 3.0	147
Ventura Publisher Gold (Publishing)	519
Windows 3.0	89
WingZ for the PC (Spreadsheet)	309
Word for Windows (Word Processing)	309

WORD PROCESSORS

Grammatik IV	49
LetterPerfect	119
Multimate 4.0	267
Professional Write with File	149
Rightwriter 4.0	Call
Sprint	117
Word	209
Word for Windows	309
Word Perfect 5.1	239
Word Perfect Add'l Station	153
Word Perfect Office	79
WordStar Professional	239

WordPerfect 5.1

$239

WordPerfect 5.1 adds even more to its top-rated product. Pull down menus, mouse support, table functions, expanded graphics, and much more have been added. Yet, it retains its classic ease-of-use!

UTILITIES

Control Room	69
CoreFast	60
Carbon Copy Plus	109
Desqview	68
Desqview 386	115
Direct Access	54
DR Dos 5.0	129
Fastback Plus	109
Formtool Gold	52
Formfiller	85
Headroom	59
Laplink III	85
MS-Dos 3.3 or 4.01	59
Norton Utilities 5.0	109
PC Anywhere III	59
PC Tools Deluxe	79
Per:Form Designer & Filler	155
PFS:Preface	43
ProComm Plus	52
Prodigy	25
QEMM 386 / QRAM	54 / 43
SideKick Plus	119
Sideways	37
Super PC Kwik	43
XTree Pro Gold	75

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* Excludes FastData products.

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DAC Bonus Pack V4 1 125
Peachtree Complete III 139

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Autosketch V2.0 85
Generic CADD Level 3 V1 1199
DesignCAD V3 0 3D 188

CD-ROM
Microsoft Bookshelf 189
NEC Clip Art 3D (PC) 239

COMMUNICATIONS
Crosstalk XVI V3 7 103
PCanywhere III V3 11 59
Procomm Plus V1 1B 61

DATABASE
Clipper 5 0 499
dBase IV V1 1 459
DBXL V1 3R 132
Paradox V3 0 439

DESKTOP PUBLISHING
Pagemaker V3 0 475
Ventura Pub V3 0 Gold 499
PFS First Pub V3 0 85

EDUCATIONAL
Microsoft Learning DOS V2 033
PC GLOBE 3 0 37
Microsoft Flight Sim V4 0 39

FINANCE
Quicken V3 0 34
Managing Your Money V6 0 112
Wealthbuilder 132

FORMS
Formworx with Fill & File 79
Formtool Gold V3.0 55
PerFORM V2.1 155

GRAPHICS
PC Paintbrush IV Plus 105
Adobe III for Win +ATM 325
Corel Draw V1.2 313
Harvard Graphics V2 3 285

INTEGRATED
Microsoft WORKS V2.0 92
PFS First Choice 98
Q&A V3 0 229

OPERATING ENVIRONMENTS
Desqview 386 V2.2 110
Microsoft Windows V3 0 89
Toolbook for Windows 279

PROGRAMMING
Turbo C++ Pro 149
Turbo Pascal V5 5 95
Microsoft Quick Basic V4.5 61
Microsoft Quick C V2 5 61

PROJECT
Microsoft Project V4.0 299
Harvard Project Mgr 3 01 402
Timeline V4.0 439

SPREADSHEETS
LUCID 3-D V2 0 54
Microsoft PC Excel 2 1 295
Quattro Professional V2 0 295
SuperCalc 5 289

Norton Advanced Utilities V5
$110

UTILITIES
BACKUP
BACK-IT 4 69
Fastback Plus V2.1 105
Norton Backup 89
PC Fullback Plus 47
GENERAL
Copy II PC V5 22
Mace Vaccine 53
Norton Editor V1 3C 45
HARD DISK
CheckIt V2.1 79
Disk Optimizer V4 05 37
Mace Utilities V1990 79
Norton Util Adv V5 0 110
Disk Technician Adv V6.0 89
PC Tools V6.0 79
Spinrite II V1.1 67
LAPTOP
Battery Watch V2.0 27
Brooklyn Bndge V3.0 79
LAP-LINK V3.0A 85
MEMORY
AboveMem 39
PopDrop Plus 55
QEMM V5.1 53
MENU
Direct Access V5.0 53
XTREE Pro Gold V1.4 75
OCR
ReadRight V2.01 329
ReadRight Personal 165

PRINT
GoScript Plus V3 0 175
PrintQ V4 0 71
Sideways V3 2 37
UltraScript PC 2.0 105

WORD PROCESSING
Microsoft WORD V5.0 209
WORD for Windows 299
RightWriter V3.1 49
AMI Professional V1 2 289
PFS Pro Write V2 2 149
Volkswriter4 99
WordPerfect V5 1 245

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Powerflex 286 40mb 1199
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Bus Versa 486/25 110mb 5495
PwrVersa 486/33 110mb 6649

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$1679
Model 101

CO-PROCESSORS
INTEL 80287-10 209
INTEL 80387-SX (16MHz) 285
INTEL 80387-20 365
INTEL 80387-25 459
INTEL 80387-33 559

DRIVES
CD-ROM
NEC CDR-35-01 399
NEC CDR-72 EXT 679
SONY CDU-510S 599
FLOPPY - Toshiba Kits
3.5" 1.44MB 85
5.25" H H 1 2MB GREY 79

HARD CARDS
Plus Hardcard II 40MB 395
Plus Hardcard II 80MB 689
WD Filecard 40MB 349

Microsoft PC EXCEL for Windows
$295

INTERNAL
CMS
ST225 20MB HD & CTRL 249
ST238 30MB HD & CTRL 269
ST251 1 40MB Drive 349
BERNOULLI 5 25 44mb 975
Micropolis
182MB HH PC PAK 1195
385MB HH PC PAK 1695
TAPE - Maynard
XL 40MB INT (5540) 249

FAX CARDS
Complete Fax 9600 439
JT Fax 4800B Int 199

GRAPHIC CARDS
ATI VGA Wonder + 256K 219
Boca 1024/VGA 139
Hercules Gph Card Plus 175
NEC Graphics Engine 16 595
PARADISE
Basic VGA 119
VGA Professional 229
VGA 1024-512K Pro 239
8514/A Plus 595
US Video VGA/NTSC 499
Video 7 VGA 1024I 256K 219

KEYBOARDS
Switchboard - Datadesk 175
KB-101 Plus - Keytronics 86

MEDIA
Bernoulli 5 25" 40mb 3-PK 239
SONY 3 1/2" DS/DD 10PK 13
SONY 3 1/2" DS/HD 10PK 22
3M 3 1/2" DS/HD 10-PK 19
3M 5 1/4" DS/DD-RH 10-PK 7
3M 5 1/4" DS HD 10 PK 12

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MEMORY BOARDS
AST Rampage 286 + 512K 385
BocaRam AT PLUS 109
Everex Ram 3000 Deluxe 85
Intel Above Bd + 512K 339

MODEMS
ATI 2400 ETC/ Int w/MNP5 155
ATI 9600 ETC/ External 499
CPI 2400S Internal 75
CPI VIVA 24 External 99
CPI VIVA 24 Ext w/MNP5 139
Everex Evercom 1200 Int 49
Everex Evercom 24 Int MNP 145
HAYES 2400B w o SW 219
Intel 2400B Classic 139
Intel Conn Coprocessor 499

MOUSE PRODUCTS
Logitech
Dexxa Serial DLX 29
Series 9 Ser Bus 65/74
Trackman Ser/Bus 75/81
Microsoft w PB&Menu Bus 97
Mouse Systems
Omni II w/Paint - Ser 39
White Mouse Ser Bus 55 69
PC Trackball Ser Bus 65 77

PANASONIC KX-P1124
$289

MONITORS
AMDEK
210+ Amber 89
Color 732 12" VGA 399
SmartScan 738 Super VGA 489
MAGNAVOX
7BM623 TTL Amber 89
7BM749 VGA Mono 139
CM9032 VGA Color 299
Super VGA Color 459
MITSUBISHI
XC1429 VGA Color 389
Diamond Scan 14" 489
NEC
MULTISYNC 2A 449
MULTISYNC 3D 629
MULTISYNC 4D 1139
MULTISYNC GS-2A 199
SAMSUNG
AMBER 14" Flat SM430 99
CGA 14" Color SC452C 199
VGA II 14" Color 349

NETWORK CARDS
NE 1000-A Ethernet-8 Bit 145
NE 2000-A Ethernet-16 Bit 175

POWER PRODUCTS
American Pwr 200VA UPS 149
American Pwr 400AT UPS 319
American Pwr 800I UPS 589

POWER PRODUCTS (Cont)
Master Piece Plus 93
Tripplite IBAR4 ISOBAR6 39 49

PRINTERS
CANON
LBP-4 LASER 899
LBP 8 MARK III 1449
LBP-8 MARK IIIR 2229
CITIZEN
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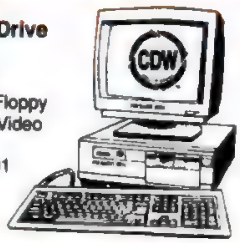

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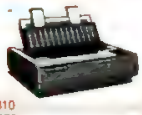

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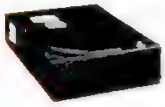

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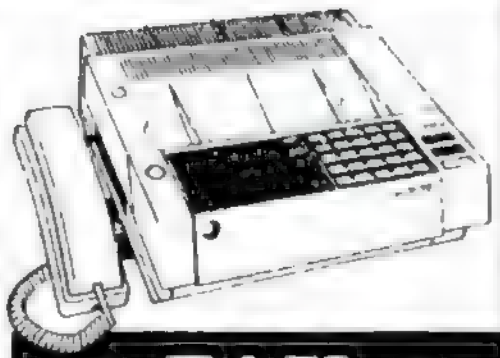

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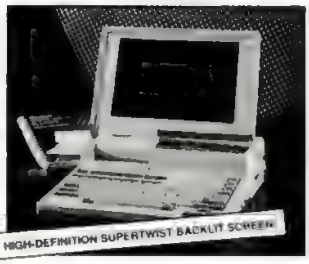

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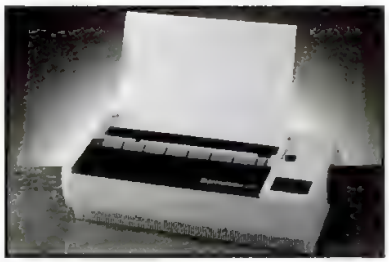

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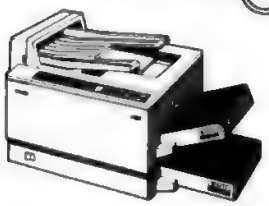

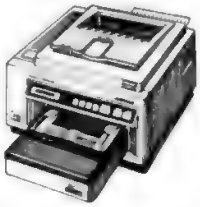

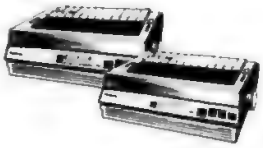

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Disk Drives 581
Diskettes 581
Expansion Units 582
Printers 583
Security 585
Tape Drive Subsystems 585

SOFTWARE

Accounting 586
CAD/CAM 586
Communications 586

SOFTWARE

Construction 587
Data Base 587
Data Entry 587
Desktop Publishing 587
Education 587
Engineering 588
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Inventory 590
Mailing Programs 590
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Source: Beta Research Study, 1988
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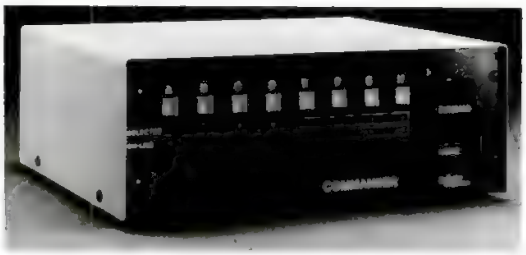

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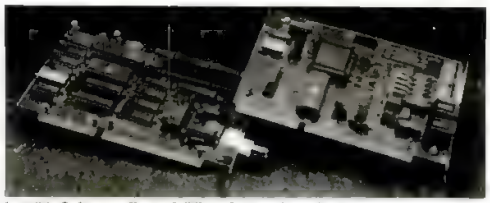

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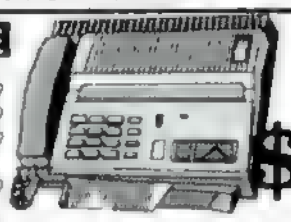

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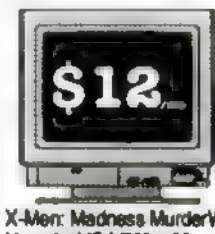

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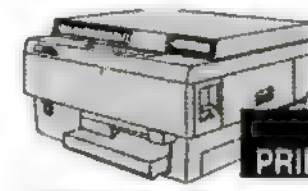

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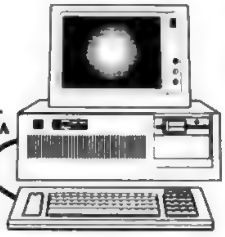

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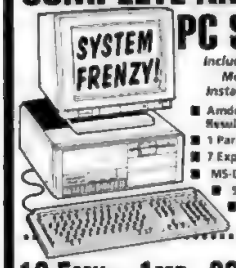

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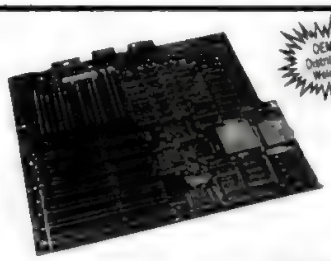

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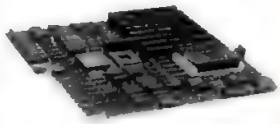

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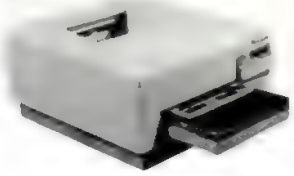

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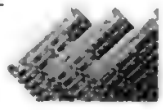

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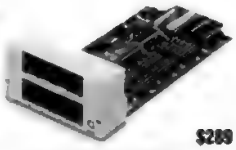

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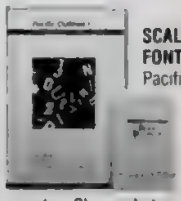

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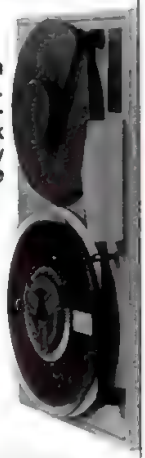

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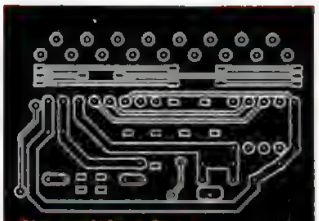

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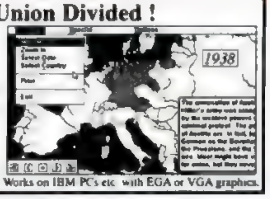

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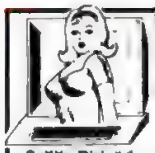

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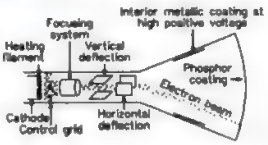

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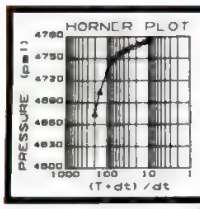

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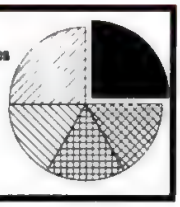

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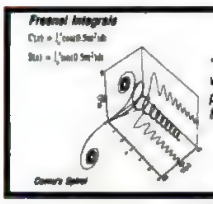

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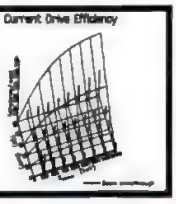

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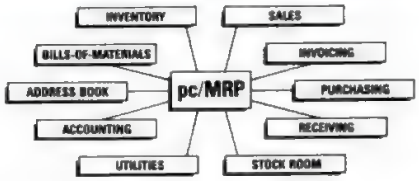

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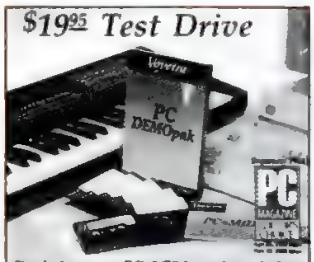

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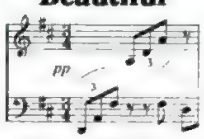

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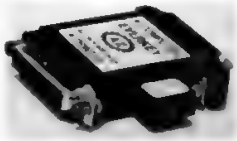

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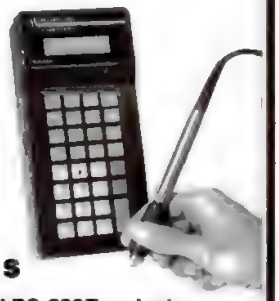

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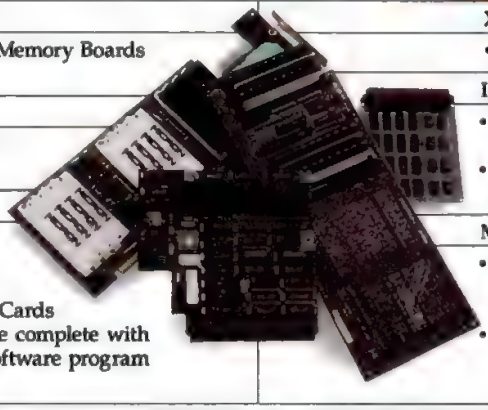

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INDEX TO ADVERTISERS

RS #	ADVERTISERS	PAGE
293	3 Com	170-171
521	3M Memory Technologies	472
234	3X USA	47
727	ASP Computer Products	341
166	AST Research	310-311
337	ATI Technologies Inc.	332
540	ATI Technologies Inc.	418
*	Acma Computers, Inc.	238-239
*	Adobe Systems Inc.	468-469
165	Advanced Logic Research	32
738	Alloy Computer Products	241
104	Altec Technology Corp.	166
281	American Power Conversion	194
248	Anvil Cases	242
*	Apple Computer	164-165
202	Arc Tangent	242
111	Arche Technologies	207
336	Arlington Computer Products	559
*	Austin Computers	9
*	Austin Computers	10-11
509	Austin Computers	12-13
129	Avery	293
527	BALER SOFTWARE	297
364	Bay Technical Associates	315
131	Bitstream	136
287	Borland International	57
285	Borland International	140-143
*	Borland International	141-142
328	Buffalo Products	250
481/141	Bulldog Computer Products	570-571
737	Bus Computer	437
116	C.P.T. DIRECT	150
185	CONNEXPERTS	344
137	CUC International	608
155	Canon, USA	183
128	Capital Equipment Corporation	88
749	Central Point Software	66
*	Central Point Software	179-180
162	Central Point Software	181
*	Checkfree Technology Inc.	467
*	Cheetah Computer Systems	529
740	Cheetah Computer Systems	530-531
348	Chipsoft	186
178	Clanon Software	485
*	Comp. Discount Warehouse (MMC)	561
109	Comp. Discount Warehouse (MMC)	560
132	Comp.U.S.A./Softwarehouse	189
*	Compaq Computer Corporation	130-131
739	Compex, Inc.	296
*	Compu-Add	159-162
*	Compu-Add	355-358
*	Compu-Add	475-478
226	CompuServe Information Service	366
205	Compuclassics	555
*	Computer Associates	402
*	Computer Associates	424
198	Core International	215
729	Corel Systems	252
*	Curtis Manufacturing	111
747	Cyrix Corp	504
183	D-Link Systems, Inc.	205
538	DAC Easy, Inc	77
389	DCA	20
*	DCA	395-396
278	DCA	397
529	DIGITAL VISION INC.	480
383	DR Discount Computers	419
150	DRESSELHAUS COMPUTER PRODUCTS	236
*	Damark International	567
*	Dataworld	18-19
472	Dell Computer Corporation	174-175
536	Dell Computer Corporation	C5-7
*	Dell Computer Corporation	C-8
470	Dell Computer Corporation	368-369
532	Dell Computer Corporation	524-525
*	Dell Computer Corporation	611-612
745	Digital Products	505
212	Dolch Computers	89
347	Dustin Discount Software	29
*	EPS Technologies	429-434
107	EVEREX	184-185
113	EVEREX	313
*	EXCEL MICRO	556
728	Eastman Kodak	133
363	Eastman Kodak	331
*	Epson	496-497
479	Ergo Computing Inc.	254-255
352	FASTMICRO	556-557
123	FTG Data Systems	480
232	Fifth Generation	22-23
288	Fifth Generation	173
*	Fifth Generation	385
236	Fifth Generation	387
286	Fifth Generation	465
282	First Source International	562
174	FormWorx Corp.	76
224	Franklin Software	88
323	Funk Software	147
305	GUI Cleaning House	502
*	Gateway 2000	113-124
146	Gateway Communications	227
372	Generic Software	420
506	Generic Software	438
*	Hard Drives International	563
136	Hayes Microcomputer Products	340
313	Helix Software	51
*	Hewlett Packard Fonts	334
*	Hewlett Packard Fonts	335
*	Hewlett Packard Network Sys.	262-263
*	Hewlett Packard Peripheral Gro	72-73
530	Hybrid Fax - Fast Fax	96
*	IBM Corp.	471
*	IBM Corp.	148-149
741	IBM Corp.	481
*	IBM Corp	69
*	IBM Corp	492
325	IQ Engineering	94
531	Inner Media	155
167	Insight Development	135
192	Intel (PCEO)	322-323
374	Intel (PCEO)	382-383
742	Intel Corporation	62-63
*	Intel Corporation	345
512	Intel Corporation	346-347
378	Iomega Corporation	372-373
480	Iverson Computer Corporation	40-41
726	KANSAI INTERNATIONAL	4
*	Kensington Microware Ltd	190
238	KLH Computers	86
237	Lasermaster	240
*	Librex Computer Systems	265-272
182	Logitech	506-507
*	Lotus Development Corp.	84-85
535	MICROBIZ	609
263	Macola Inc.	139
291	Map Info	425
*	Mark Williams	223
154	Mathsoft Inc.	259
*	Maxell	371
376	Meca	499
144	Meca	604
317	Megadrive Systems, Inc	212
307	Micro National	558
*	MicroLab	208-209
*	MicroLab	210-211
225	MicroWarehouse Inc	230
225	MicroWarehouse Inc	231-232
225	MicroWarehouse Inc.	233
225	MicroWarehouse Inc.	234-235
*	Micrografx	74
370	Micron Technology	600
*	Microsoft	2-3
*	Microsoft	243
*	Microsoft	244-245
*	Microsoft	318-319
*	Microsoft	541
394	Microspeed	543
489	Midwest Computer Works	568
240	Mountain Computer	26
170	Multisoft Corporation	290
157	NEC TECHNOLOGIES INC.	168
*	NEC TECHNOLOGIES INC.	407
*	NEC TECHNOLOGIES INC.	409
*	NEC TECHNOLOGIES INC.	410-411
335	NEC TECHNOLOGIES INC.	415
*	NEC Technologies, Inc.	1
153	NEC Technologies, Inc.	C2-4
*	NEC Technologies, Inc.	412-413
*	NEC Technologies, Inc.	487
217	NEC Technologies, Inc.	489
*	Northgate Computer Systems	451
*	Northgate Computer Systems	452-453
*	Northgate Computer Systems	454-455
*	Northgate Computer Systems	456-457
*	Northgate Computer Systems	458-459
*	Northgate Computer Systems	460-461
*	Northgate Computer Systems	462
*	Northgate Computer Systems	490-491
*	Northgate Computer Systems	500-501
*	Northgate Computer Systems	544-545
322	Novell Data Systems	218-219
362	OCR Systems	216
235	Olodata	326-327
168	Olivetti	482
*	Oracle	82
245	Output Technology	221
301	PATTON & PATTON	443
*	PC Brand	298-299
*	PC Brand	300-301
*	PC Brand	302-303
303	PC Brand	304-305
280	PC Brand	392-393
368	PC Brand	520-521
523	PC Brand	564-565
*	PC Connection	280-287
140	PC Publishing	292
*	PC Zones Int'l. Inc	197-198
*	PRINCETON PUBLISHING	337-338
*	Pacific Data Products	145
241	Pacific Data Products	291
*	Pacific Data Products	306
*	Panasonic OA	361
138	Panasonic OA	362-363
722	Parsons Technology	16
358	Peachtree Software	427
733	Peter Norton Computing	508
147	Plus Development	365
219	Practical Peripherals, Inc.	350
148	Primavera Systems	70
190	Procom Technology	247
342	Protec Microsystems, Inc.	228
259	QMS	5
338	Quarterdeck Office Systems	45
283	Realworld Corp.	193
534	Reference Software	71
290	Rose Electronics	333
537	SAINT CROIX COMPUTER	330
296	SAMTRON	128
541	SBT Corp.	295
365	STSC	484
299	SWFTE International	37
143	Samna	248
*	Seagate	388-389
326	Sears Business Systems	399
724	Softlogic Solutions	14
539	Softview, Inc.	450
393	Software Link, Inc	442
*	Software Publishing	54
*	Software Publishing	237
377	Sony Magnetic Products Co	353
346	Speciality Software	526
731	Stac Electronics	534-537
*	Stac Electronics	535-538
163	Standard Computer Corp.	52-53
173	Star Micronics	416-417
268	Swan Technologies	375-379
344	Symantec	59
264	Symantec	348-349
110	Systems Compatability	157
381	TEAC Corporation of America	546
477	TRW Customer Service Division	448
*	Tandon Computer Corporation	97
*	Tandon Computer Corporation	98-99
*	Tandon Computer Corporation	100-101
*	Tandon Computer Corporation	102-103
508	Tandon Computer Corporation	104-105
391	Tangent Computer, Inc.	127
294	Tatung	401
181	Techware	400
384	Tecmar	24-25
*	Telemart	90-91
206	Telemart	92-93
306	Tenex Computer Express	562
499	Texas Instruments	39
354	Texas Instruments	405
524	The New MMI	202-203
379	Toshiba of America	276-277
231	Touchbase Systems	28
743	Traveling Software	441
228	Treasure Chest	61
121	Tri-Star Computer	17
515	Truevision Inc.	246
310	Twinhead	177
345	U-SAVE	21
230	US Sage	201
367	Universal Data Systems	550
247	Ventura Software Inc.	445
175	Ventura Software Inc.	447
350	W.L.T. Systems, Inc.	42
*	Wordperfect	106
*	Wordperfect	257
211	Xircom	229
139	Zaki Corp.	421
732	Zenith Data Systems	64
721	Zeos International	30-31
*	Zeos International	48a-h
388	Zeos International	78-79
723	Zeos International	80
487	Zeos International	342-343
493	Zeos International	422-423
*	Zeos International	511-518
115	Zeos International	519

*-No Reader Service #. Please call advertiser for information

ADVERTISERS PRODUCT INDEX

RS#	ADVERTISER	PRODUCT	PAGE#
ACCOUNTING SOFTWARE			
348	Chipsoft	TURBO TAX	186
538	DAC Easy, Inc	ACCOUNTING SOFTWARE	77
535	MICROBIZ	ACCOUNTING SOFTWARE	609
263	Macola Inc	ACCOUNTING SOFTWARE	139
722	Parsons Technology	FINANCIAL SOFTWARE	16
358	Peachtree Software	ACCOUNTING SOFTWARE	427
283	Peakworld Corp	ACCOUNTING SOFTWARE	193
541	SBT Corp	ACCOUNTING DATABASE SOFTWARE	295
DATABASE MANAGERS			
287	Borland International	PARADOX	57
178	Clarion Software	PROFESSIONAL DEVELOPER	485
291	Map Info	MAP INFO DATABASE	425
•	Oracle	ORACLE	82
541	SBT Corp	ACCOUNTING DATABASE SOFTWARE	295
FINANCIAL PLANNING SOFTWARE			
722	Parsons Technology	FINANCIAL SOFTWARE	722
INTEGRATED SOFTWARE			
344	Symantec	Q & A	59
LANGUAGES			
•	Mark Williams	COHERENT UNIX OPERATING SYSTEM	223
•	Microsoft	QUICK C ASM	541
241	Pacific Data Products	PACIFIC PAGE	291
•	Pacific Data Products	25 IN 1	145
OPERATING SYSTEMS/ENVIRONMENTS			
•	Mark Williams	COHERENT UNIX OPERATING SYSTEM	223
•	Microsoft	WINDOWS COMPUTING (PLATFORM)	244-245
•	Microsoft	WORD FOR WINDOWS	318-319
338	Quarterdeck Office Systems	MEMORY MANAGEMENT	45
338	Quarterdeck Office Systems	OPERATING ENVIRONMENT DIAGNOST	45
724	Softlogic Solutions	SOFTWARE CAROUSEL	14
393	Software Link, Inc	OPERATING SYSTEMS/ENVIRONMENTS	442
PROGRAM DEVELOPERS/GENERATORS			
178	Clarion Software	PROFESSIONAL DEVELOPER	485
PROJECT MANAGEMENT			
•	Computer Associates	SUPER PROJECT	402
148	Primavera Systems	PROJECT MANAGEMENT SOFTWARE	70
STATISTICAL SOFTWARE			
365	STSC	STAT SOFTWARE	484
TEXT EDITORS			
286	Fifth Generation	MACE UTILITIES	465
UTILITIES			
129	Avery	LASERPRO SOFTWARE	293
131	Bitstream	FACELIFT	136
328	Buffalo Products	PRINTING & FILE UTILITY TRANSF	250
748	Central Point Software	PC TOOLS DELUXE	66
162	Central Point Software	CENTRAL POINT BACK-UP	181
•	Central Point Software	CENTRAL POINT BACK-UP	179-180
•	Fifth Generation	FASTBACK PLUS	385
236	Fifth Generation	FASTBACK PLUS	387
288	Fifth Generation	DIRECT ACCESS MENU	173
286	Fifth Generation	MACE UTILITIES	465
224	Franklin Software	LANGUAGE MASTER	68
323	Funk Software	SIDEWAYS	147
313	Helix Software	HEADROOM	51
167	Insight Development	PRINTER UTILITIES	135
170	Multisoft Corporation	SUPER PC KWIK	290
140	PC Publishing	SPREADSHEET ADD ON UTILITY	292
241	Pacific Data Products	PACIFIC PAGE	291
•	Pacific Data Products	25 IN 1	145
733	Peter Norton Computing	UTILITIES 5 0	508
290	Rose Electronics	E-MAIL FILE TRANSFER, PRINTER	333
724	Softlogic Solutions	SOFTWARE CAROUSEL	14
264	Symantec	NORTON ANTIVIRUS	348-349
110	Systems Compatability	OUTSIDE IN	157
743	Traveling Software	LAPLINK	441
WORD PROCESSING SOFTWARE AIDS			
232	Fifth Generation	LOGICAL CONNECTION PLUS	22-23
224	Franklin Software	LANGUAGE MASTER	68
•	Microsoft	PC WORD	2 3
241	Pacific Data Products	PACIFIC PAGE	291
•	Pacific Data Products	25 IN 1	145
290	Rose Electronics	MASTER SWITCH/MASTERNET	333
143	Samna	WORD PROCESSING	248
•	Software Publishing	PROFESSIONAL WRITE 2 2	54
110	Systems Compatability	OUTSIDE IN	157
•	Wordperfect	WORD PROCESSING SOFTWARE	106
CAD/CAM			
506	Generic Software	AUTOSKETCH	438
372	Generic Software	GENERIC CADD 5 0	420
154	Mattsoft Inc	PC CAD V 2 5	259
SPREADSHEET/TEMPLATES			
527	NALES	SOFTWARE SPREADSHEETS	297
•	Borland International	QUATRO PRO	141-142
285	Borland International	QUATTRO PRO	140-143
323	Funk Software	SIDEWAYS	147
•	Lotus Development Corp	LOTUS 123 3 1	84-85
140	PC Publishing	SPREADSHEET ADD ON UTILITY	292
DESK TOP PUBLISHING			
741	Bell Corp	INTERLEAF	481
237	Lasermaster	1000 PERSONAL TYPESETTER	240
241	Pacific Data Products	PACIFIC PAGE	291
•	Pacific Data Products	25 IN 1	145
299	SWIFTE International	GLYPHIX	37
247	Ventura Software Inc	XEROX VENTURA	445
DATA ENTRY SOFTWARE			
362	OCR Systems	READRIGHT 2 01	216
TAX SOFTWARE			
348	Chipsoft	TURBO TAX	186
538	DAC Easy Inc	TAX PACKAGE	77
144	Meca	TAX CUT	804
539	Software, Inc	WINDOWS BASED TAX SOFTWARE	450
VERTICAL MARKET SOFTWARE			
291	Map Info	MAP INFO DATABASE	425
EDUCATIONAL SOFTWARE			
534	Reference Software	GRAMMATIK WINDOWS	71
HOME MANAGEMENT SOFTWARE			
376	Meca	HOME LAWYER	9
FORM DESIGNERS			
174	FormWorx Corp	FORMS SOFTWARE	76
175	Ventura Software Inc	FORM BASE	447
PRE-PRINTED FORM SOFTWARE			
175	Ventura Software Inc	FORM BASE	447
FONT SOFTWARE			
131	Bitstream	FACELIFT	136
•	Hewlett Packard Fonts	FONTS	334
•	Hewlett Packard Fonts	FONTS	335
241	Pacific Data Products	PACIFIC PAGE	291
•	Pacific Data Products	25 IN 1	145
MAILING SOFTWARE			
202	Arc Tangent	MAIL LIST SOFTWARE	242
DIAGNOSTIC SOFTWARE			
338	Quarterdeck Office Systems	MEMORY MANAGEMENT	45
338	Quarterdeck Office Systems	OPERATING ENVIRONMENT DIAGNOST	45
MAPPING SOFTWARE			
291	Map Info	MAP INFO DATABASE	425
FLOWCHARTING			
301	PATTON & PATTON	FLOW CHART SOFTWARE	443
WINDOWS SOFTWARE			
•	Adobe Systems Inc	ADOBE ATM WINDOWS	468-469
305	GUI Cleaning House	MAIL ORDER	502
531	Inner Media	WIDE ANGLE	156
•	Microsoft	WINDOWS COMPUTING (PLATFORM)	243
•	Microsoft	WORD FOR WINDOWS	318-319
534	Reference Software	GRAMMATIK WINDOWS	71
539	Software Inc	WINDOWS BASED TAX SOFTWARE	450
535	MICROBIZ	RETAIL CONTROLLER JR	609
731	Stac Electronics	STACKER	534-535
COMPATIBLE KEYBOARDS			
•	Northgate Computer Systems	KEYBOARDS	500-501
BACKUP SOFTWARE			
•	Fifth Generation	FASTBACK PLUS	385
236	Fifth Generation	FASTBACK PLUS	387
DISK BACKUP & TAPE DRIVES			
521	3M Memory Technologies	DATA STORAGE PRODUCT	472
748	Central Point Software	PC TOOLS DELUXE	66
196	Core International	TAPE BACK UP	215
317	Megadrive Systems, Inc	REMOVABLE HARD DRIVES	212
240	Mountain Computer	BACK UP SYSTEMS	290
190	Procom Technology	STORAGE PERIPHERALS	247
•	Seagate	DISK DRIVE	388-389
377	Sony Magnetic Products Co	DATA CARTRIDGES	353
381	TEAC Corporation of America	DATA STORAGE, TAPE DRIVE, BACK UP	346
384	Tecmar	MASS STORAGE, TAPE DRIVE	24-25
HARD DISKS			
317	Megadrive Systems, Inc	REMOVABLE HARD DRIVES	212
147	Plus Development	HARD IDX	366
190	Procom Technology	STORAGE PERIPHERALS	247
•	Stac Electronics	STACKER	535-536
COMPUTERS/COMPATIBLES			
•	Acma Computers, Inc	ACMA PC S	238-239
165	Advanced Logic Research	POWER FLEX	32
738	Alloy Computer Products	EARTH STATION	241
104	Altec Technology Corp	PC'S	168
111	Archie Technologies	ARCHE SYSTEMS	207
•	Austin Computers	PC S	8
•	Austin Computers	PC'S	10-11
509	Austin Computers	PC'S	12-13
118	C P T	DIRECT COMPATIBLES	150
•	Cheetah Computer Systems	COMPATIBLES	529
740	Cheetah Computer Systems	COMPATIBLES	530-531
109	Comp Discount Warehouse (MMC)	COMPATIBLES	560
•	Comp Discount Warehouse (MMC)	COMPATIBLES	561
132	Comp U S A /Softwarehouse	PC S	180
•	Compaq Computer Corporation	PC'S	130-131
•	Compu-Add	COMPU ADD SYSTEMS	158-162
•	Compu-Add	316SL	475-478
383	DR Discount Computers	COMPUTERS/COMPATIBLES	419
•	Dataworld	PC S	18-19
472	Dell Computer Corporation	386 SX 16	174-175
532	Dell Computer Corporation	DELL PC'S	524-525
470	Dell Computer Corporation	DELL PC S	368-369
536	Dell Computer Corporation	DELL PC S	C5-7
•	Dell Computer Corporation	DELL PC S	C-6
•	Dell Computer Corporation	DELL PC S	611-612
•	[illegible] Technologies	COMPATIBLES	479-484
107	EVEREX	EVEREX 486 SYSTEMS	184-185
•	EXCEL	MICRO COMPUTERS/COMPATIBLES	566
•	Epson	EPSON COMPUTERS	496-497
479	Ergo Computing Inc	PC S	254-255
•	Gateway 2000	COMPATIBLES	113-124
•	IBM Corp	PS/2	148-149
480	Iverson Computer Corporation	COMPUTER COMPATIBLES	40-41
•	Libtex Computer Systems	PC S	265-272
•	MicroLab	COMPATIBLES	208-209
•	MicroLab	COMPATIBLES	210-211
157	NEC Technologies Inc	POWERMATE 386/25S	168
•	Northgate Computer Systems	COMPATIBLES	451
•	Northgate Computer Systems	COMPATIBLES	452-453
•	Northgate Computer Systems	COMPATIBLES	454-455
•	Northgate Computer Systems	COMPATIBLES	456-457
•	Northgate Computer Systems	COMPATIBLES	458-459
•	Northgate Computer Systems	COMPATIBLES	460-461
•	Northgate Computer Systems	COMPATIBLES	462
•	Northgate Computer Systems	COMPATIBLES	544-545
•	Northgate Computer Systems	COMPATIBLES	490-491
•	Northgate Computer Systems	COMPATIBLES	500-501
168	Olivetti	PC S	482
•	PC Brand	PC S	298-299
•	PC Brand	PC S	300-301
•	PC Brand	PC S	302-303
303	PC Brand	PC S	304-305
364	PC Brand	PC S	520-521
523	PC Brand	PC S	564-565
238	PREMIER INNOVATIONS	PC S	86
537	Saint Croix Computer	COMPATIBLES	330
326	Sears Business Systems	TOSHIBA T1200 XE	399
163	Standard Computer Corp	PC S	52-53
•	Swan Technologies	MAIL ORDER	375-378
268	Swan Technologies	MAIL ORDER	379
•	Tandon Computer Corporation	COMPATIBLES	97
•	Tandon Computer Corporation	COMPATIBLES	98-99
•	Tandon Computer Corporation	COMPATIBLES	100-101
•	Tandon Computer Corporation	COMPATIBLES	102-103
508	Tandon Computer Corporation	COMPATIBLES	104-105
391	Tangent Computer Inc	486 PC	127
•	Telemart	PC S	90-91
206	Telemart	PC S	92-93
306	Tenex Computer Express	MAIL ORDER	562
524	The New MMI	MAIL ORDER	202-203
228	Treasure Chest	PC S	61
121	Tri-Star Computer	COMPUTERS/COMPATIBLES	17
350	W L T Systems, Inc	PC S	42
211	Xircom	ETHERNET ADAPTER CARD	421
732	Zenith Data Systems	COMPATIBLES	64
115	Zeos International	Z-CARD	519
493	Zeos International	COMPATIBLES	422-423
721	Zeos International	COMPATIBLES	30-31
388	Zeos International	ZEOS NOTE-BOOK LAPTOP	78-79
467	Zeos International	COMPATIBLES	342-343
723	Zeos International	COMPATIBLES	80
•	Zeos International	COMPATIBLES	511-516
•	Zeos International	COMPATIBLES	48-55
INPUT DEVICES			
123	FTG Data Systems	FT100 PRECISION LIGHT PEN	480
•	Kensington Microware Ltd	EXPERT MOUSE	190
182	Logitech	SCAN MAN 256	506-507
394	Microspeed	PC-TRAC	543
362	OCR Systems	READRIGHT 2 01	216
PROGRAMMERS TOOLS UTILITIES			
•	Mark Williams	COHERENT UNIX OPERATING SYSTEM	223
338	Quarterdeck Office Systems	MEMORY MANAGEMENT	45
338	Quarterdeck Office Systems	OPERATING ENVIRONMENT DIAGNOST	45
MULTIFUNCTION BOARDS			
123	FTG Data Systems	FT100 PRECISION LIGHT PEN	480
ADD-ON BOARDS			
293	3 Com	ETHERLINK	170-171
128	Capital Equipment Corporation	ADD IN BOARDS	88
123	FTG Data Systems	FT100 PRECISION LIGHT PEN	480
237	Lasermaster 1000	PERSONAL TYPESETTER	240
370	Micron Technology	ADD-ON BOARD	600
370	Micron Technology	MEMORY BOARDS	600
•	Pacific Data Products	MEMORY BOARD	306
515	Truevision Inc	VIDEO GRAPHICS BOARD	246
SCANNERS/DIGITIZERS			
529	Digital Vision Inc	COMPUTER EYES	480
362	OCR Systems	READRIGHT 2 01	216
PRINTERS			
129	Avery	LASERPRO SOFTWARE	293
328	Buffalo Products	PRINTER SHARING DEVICE	258
155	Canon USA	LASER BEAM PRINTERS	183
155	Canon, USA	BJ10e BUBBLE JET PRINTER	183
363	Eastman Kodak	DICONIX 150 PLUS PORTABLE	331
728	Eastman Kodak	DICONIX COLOR 4 PRINTER	133
•	Hewlett Packard Peripheral Grp	SCANJET	72-73
•	IBM Corp	PRINTERS	471
237	Lasermaster 1000	PERSONAL TYPESETTER	240

RS#	ADVERTISER	PRODUCT	PAGE#
*	NEC Technologies Inc.	PRINTERS	407
*	NEC Technologies Inc.	PRINTERS	409
*	NEC Technologies Inc.	PRINTERS	410-411
335	NEC Technologies Inc.	PRINTERS	415
*	NEC Technologies, Inc.	PRINTERS	412-413
235	Okidata	PRINTERS	326-327
241	Pacific Data Products	PACIFIC PAGE	291
*	Pacific Data Products	25 IN 1	145
*	Panasonic OA	DOT MATRIX MONITORS	361
138	Panasonic OA	DOT MATRIX PRINTERS	362-363
258	QMS	LASER PRINTER	5
290	Rose Electronics	PRINTER SHARING SWITCHES	333
173	Star Micronics	PRINTERS	416-417
354	Texas Instruments	MICROLASER	39
FLOPPY DISK DRIVES			
190	Procom Technology	STORAGE PERIPHERALS	247
FONT CARTRIDGES			
325	IQ Engineering	FONT CARTRIDGE	94
TRACK BALLS			
*	Kensington Microware Ltd	EXPERT MOUSE	190
731	Stac Electronics	STACKER	534-537
PRINTER ACCESSORIES			
727	ASP Computer Products	PRINTER SHARING	341
150	Dresselhaus Computer Products	PRINTER SHARING DEVICE	236
745	Digital Products	PRINTER SHARING DEVICE	505
232	Fifth Generation	LOGICAL CONNECTION PLUS	22-23
167	Insight Development	PRINTER UTILITIES	135
726	Kansai International	PRINTER SHARING DEVICE	4
237	Lasermaster 1000	PERSONAL TYPESETTER	240
245	Output Technology	850-DOT MATRIX PRINTER	221
241	Pacific Data Products	PACIFIC PAGE	291
*	Pacific Data Products	25 IN 1	145
237	Lasermaster 1000	PERSONAL TYPESETTER	240
PORTABLE/LAP COMPUTERS			
166	AST Research	NOTEBOOK PC	310-311
326	Buffalo Products	TOSHIBA MEMORY BOARDS	256
737	Bus Computer	NOTEBOOK-SIZED 386SX VGA	437
*	Compu-Add	316SL	158-162
183	D-Link Systems, Inc	POCKET LAN ADAPTER	205
212	Dolch Computers	DOLCH P A C	89
217	NEC Technologies, Inc	ProSpeed SX/20	489
326	Sears Business Systems	TOSHIBA T1200 XE	399
*	Tandon Computer Corporation	PORTABLES	97
*	Tandon Computer Corporation	PORTABLES	98-99
*	Tandon Computer Corporation	PORTABLES	100-101
*	Tandon Computer Corporation	PORTABLES	102-103
508	Tandon Computer Corporation	PORTABLES	104-105
498	Texas Instruments	LAPTOP	405
379	Toshiba of America	PORTABLES	276-277
310	Twinhead	LAPTOP	177
211	Xircom	ETHERNET ADAPTER CARD	421
732	Zenith Data Systems	LAPTOP	64
388	Zeos International	ZEOS NOTEBOOK LAPTOP	78-79
PC-FAX			
234	3X USA Pyp96	FAX BOARD	47
113	EVEREX	EVEREX FAX/MODEM	313
530	Hybrid Fax - Fast Fax	FAX-PC	96
374	Intel (PCEO)	FAX BOARD	382-383
231	Touchbase Systems	WORLDPORT FAX/MODEMS	28
CO-PROCESSORS			
747	Cyrix Corp	MATH COPROCESSOR	504
*	Intel Corporation	MATH CO-PROCESSOR	345
512	Intel Corporation	MATH CO-PROCESSOR	346-347
OPTICAL PERIPHERALS			
190	Procom Technology	STORAGE PERIPHERALS	247
MEMORY SUBSYSTEMS			
378	Iomega Corporation	BERNOULLI BOX	372-373
*	Pacific Data Products	MEMORY BOARD	306
190	Procom Technology	STORAGE PERIPHERALS	247
308	Texas Computer Express	MEMORY PRODUCTS	562
OS/2 SOFTWARE			
305	GUI Cleaning House	MAIL ORDER	502
CD-ROM			
190	Procom Technology	STORAGE PERIPHERALS	247
CHIPS/PROCESSORS			
*	Intel Corporation	MATH CO-PROCESSOR	345
512	Intel Corporation	MATH CO-PROCESSOR	346-347
742	Intel Corporation	CHIPS/PROCESSORS	62-63
346	Specialty Software	MATH CO-PROCESSORS	526
DISPLAYS/MONITORS/TERMINALS			
153	NEC Technologies, Inc	MULTISYNC MONITORS	C2-4
*	NEC Technologies Inc	MULTISYNC MONITORS	1
*	Princeton Publishing	MONITORS	337-338
296	Samtron	RENITOR	128
294	Taiwing	MONITOR	401
181	Techware	MONITOR	400
GRAPHICS SOFTWARE			
729	Corel Systems	COREL DRAW	252
*	Hewlett Packard Network Sys	NEW WAVE SOFTWARE	262-263
*	Micrografx	CHARISMA	74
362	OCR Systems	READRIGHT 2 01	216
143	Samna	GRAPHICS SOFTWARE	248
*	Software Publishing	HARVARD GRAPHICS	237
*	Wordperfect	GRAPHICS SOFTWARE	257
PLOTTERS/CHARTING DEVICES			
241	Pacific Data Products	PACIFIC PAGE	291
*	Pacific Data Products	25 IN 1	145
VIDEO GRAPHICS BOARDS			
540	ATI Technologies Inc	VGA WONDER +	418
370	Micron Technology	VIDEO PRODUCTS	600
153	NEC Technologies, Inc	MULTISYNC GRAPHICS ENGINE BOARD	2-4
*	NEC Technologies, Inc	MULTISYNC GRAPHICS ENGINE BOARD	1
515	Truevision Inc.	VIDEO GRAPHICS BOARD	246
COMMUNICATIONS SOFTWARE			
326	Buffalo Products	PRINTING & FILE UTILITY TRANSF	250
749	Central Point Software	PC TOOLS DELUXE	66
278	DCA	DCA CROSSTALK COMMUNICATIONS	397
*	DCA	DCA CROSSTALK COMMUNICATIONS	395
541	SBT Corp	ACCOUNTING DATABASE SOFTWARE	295
743	Traveling Software	LAPLINK	441
LOCAL AREA NETWORKING			
293	3 Com	ETHERLINK	170-171
738	Alloy Computer Products	EARTH STATION	241
326	Buffalo Products	PRINTER SHARING DEVICE	250
185	CONNEXPERTS	SYSTEMIZED	344
739	Compex, Inc	READYLINK	296
*	Compu-Add	COMPU ADD TOWER	158-162
*	Computer Associates	NETMAN	424
183	D-Link Systems, Inc	POCKET LAN ADAPTER	205
369	DCA	DCA IRMA trac Token-Ring	20
745	Digital Products	PRINTER SHARING DEVICE	505
232	Fifth Generation	LOGICAL CONNECTION PLUS	22 23
146	Gateway Communications	ETHERNET BOARD	227
322	Novell Data Systems	NOVELL NETWORKING PRODUCTS	218-219
241	Pacific Data Products	PACIFIC PAGE	291
*	Pacific Data Products	25 IN 1	145
342	Protec Microsystems, Inc	BYTELINK	228
290	Rose Electronics	PERIPHERAL SHARING SWITCHES	333
230	US Sage	MAIN LAN	201
211	Xircom	ETHERNET ADAPTER CARD	229
MODEMS			
337	ATI Technologies Inc	9600 ETC/E MODEM	332
113	EVEREX	EVEREX FAX/MODEM	313
136	Hayes Microcomputer Products	MODEMS	340
192	Intel (PCEO)	MODEMS	322-323
219	Practical Peripherals, Inc	MODEM	350
231	Touchbase Systems	WORLDPORT FAX/MODEMS	28
357	Universal Data Systems	MODEMS	550
EMULATORS/PROTOCOL CONVERTERS			
241	Pacific Data Products	PACIFIC PAGE	291
*	Pacific Data Products	25 IN 1	145
MULTIUSER SYSTEMS			
738	Alloy Computer Products	EARTH STATION	241
232	Fifth Generation	LOGICAL CONNECTION PLUS	22 23
*	Mark Williams	COHERENT UNIX OPERATING SYSTEM	223
342	Protec Microsystems, Inc	BYTELINK	228

RS#	ADVERTISER	PRODUCT	PAGE#
290	Rose Electronics	MASTER SWITCH	333
230	US Sage	MAIN LAN	201
139	Zale Corp.	MULTIUSER SOFTWARE	64
SOFTWARE MEDIA SHARING			
290	Rose Electronics	COMMUNICATIONS SOFTWARE	333
PERIPHERAL SHARING DEVICE			
727	ASP Computer Products	PRINTER SHARING	341
364	Bay Technical Associates	PERIPHERAL SHARING DEVICE	315
326	Buffalo Products	PRINTER SHARING DEVICES	250
150	Dresselhaus Computer Products	PRINTER SHARING DEVICE	236
726	Kansai International	PRINTER SHARING DEVICE	4
342	Protec Microsystems, Inc	BYTELINK	228
290	Rose Electronics	MASTER SWITCH	333
DISKETTES			
521	3M Memory Technologies	DATA STORAGE PRODUCT	472
*	Maxell	FLOPPY DISKS	371
MAINTENANCE			
477	TRW Customer Service Division	SERVICE	448
POWER PROTECTION			
281	American Power Conversion	UPS	194
PC ACCESSORIES			
248	Anvil Cases	COMPUTER EQUIPMENT CASES	242
*	Curtis Manufacturing	ACCESSORIES	111
*	IBM Corp	SUPPLIES	492
*	Stac Electronics	STACKER	535
RETAIL DISTRIBUTORS			
326	Sears Business Systems	TOSHIBA T1200 XE	399
MAIL ORDER			
*	PC Connection	MAIL ORDER	280-287
*	Acma Computers Inc	ACMA PC'S	238-239
104	Altec Technology Corp	MAIL ORDER	166
338	Arlington Computer Products	MAIL ORDER	559
*	Austin Computers	MAIL ORDER	9
*	Austin Computers	MAIL ORDER	10-11
508	Austin Computers	MAIL ORDER	12-13
461/141	Bulldog Computer Products	MAIL ORDER	570-571
118	C P T	DIRECT COMPATIBLES	150
*	Cheetah Computer Systems	COMPATIBLES	529
740	Cheetah Computer Systems	COMPATIBLES	530-531
109	Comp Discount Warehouse (MMC)	MAIL ORDER	560
*	Comp Discount Warehouse (MMC)	MAIL ORDER	561
132	Comp U S A /Softwarehouse	MAIL ORDER	189
*	Compu-Add	MAIL ORDER	158-162
*	Compu-Add	COMPU ADD SYSTEMS	355-358
*	Compu-Add	316SL	475-478
205	Compuclassics	MAIL ORDER	565
383	DR Discount Computers	MAIL ORDER	419
*	Demark International	MAIL ORDER	567
532	Dell Computer Corporation	DELL PC'S	524-525
470	Dell Computer Corporation	DELL PC'S	368-369
536	Dell Computer Corporation	DELL PC'S	C5-7
*	Dell Computer Corporation	DELL PC'S	C-8
*	Dell Computer Corporation	DELL PC'S	611-612
347	Dustin Discount Software	MAIL ORDER SOFTWARE	29
*	EPS Technologies	COMPATIBLES	429-434
*	EXCEL MICRO	COMPUTERS/COMPATIBLES	566
352	FASTMICRO	MAIL ORDER	556-557
282	First Source International	MAIL ORDER	562
305	GUI Cleaning House	MAIL ORDER	502
*	Gateway 2000	COMPATIBLES	113-124
*	Hard Drives International	MAIL ORDER	563
535	MICROBIZ	MAIL ORDER	609
*	Mark Williams	COHERENT UNIX OPERATING SYSTEM	223
307	Micro National	MAIL ORDER	558
*	MicroLab	MAIL ORDER	208-209
*	MicroLab	MAIL ORDER	210-211
225	MicroWarehouse Inc	MAIL ORDER	230
225	MicroWarehouse Inc	MAIL ORDER	233
225	MicroWarehouse Inc	MAIL ORDER	231-232
225	MicroWarehouse Inc	MAIL ORDER	234-235
489	Midwest Computer Works	MAIL ORDER	568
*	Northgate Computer Systems	MAIL ORDER	451
*	Northgate Computer Systems	MAIL ORDER	452-453
*	Northgate Computer Systems	MAIL ORDER	454-455
*	Northgate Computer Systems	MAIL ORDER	456-457
*	Northgate Computer Systems	MAIL ORDER	458-459
*	Northgate Computer Systems	MAIL ORDER	460-461
*	Northgate Computer Systems	MAIL ORDER	462
*	Northgate Computer Systems	MAIL ORDER	544-545
*	Northgate Computer Systems	MAIL ORDER	490-491
*	Northgate Computer Systems	COMPATIBLES	500-501
*	PC Brand	MAIL ORDER	298-299
*	PC Brand	MAIL ORDER	300-301
*	PC Brand	MAIL ORDER	302-303
303	PC Brand	MAIL ORDER	304-305
368	PC Brand	MAIL ORDER	520-521
280	PC Brand	MAIL ORDER	392-393
523	PC Brand	MAIL ORDER	564-565
*	PC Zones Inc'l Inc	MAIL ORDER/SOFTWARE	197-198
537	Saint Croix Computer	COMPATIBLES	330
*	Swan Technologies	MAIL ORDER	375-378
268	Swan Technologies	MAIL ORDER	379
*	Telemart	MAIL ORDER	90-91
206	Telemart	MAIL ORDER	92-93
308	Texas Computer Express	MAIL ORDER	562
524	The New MMI	MAIL ORDER	202-203
345	U-SAVE	MAIL ORDER	21
115	Zeos International	[illegible]	519
493	Zeos International	COMPATIBLES	422-423
721	Zeos International	COMPATIBLES	30-31
388	Zeos International	ZEOS NOTEBOOK LAPTOP	78-79
487	Zeos International	COMPATIBLES	342-343
723	Zeos International	COMPATIBLES	80
*	Zeos International	COMPATIBLES	511-518
*	Zeos International	COMPATIBLES	48a-h
ON LINE DATABASES			
137	CUC International	COMP-U-STORE ON-LINE	606
*	Checkfree Technology Inc	ON-LINE SERVICE	467
228	CompuServe Information Service	ON-LINE SERVICE	366
APPLE PRODUCTS			
*	Apple Computer	APPLE HARDWARE PRODUCTS	164-165
UNIX PRODUCTS			
*	Compu-Add	COMPU ADD TOWER	158-162
*	Mark Williams	COHERENT UNIX OPERATING SYSTEM	223
MISCELLANEOUS			
248	Anvil Cases	COMPUTER EQUIPMENT CASES	242
*	IBM Corp	MALCOLM BALDRIDGE AWARD	471
291	Map Info	MAP INFO DATABASE	425
DIRECT MARKETING CONNECTION			
338	Arlington Computer	MAIL ORDER	559
461/141	Bulldog Computer	MAIL ORDER	570-571
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109	Comp Discount Warehouse(MMC)	MAIL ORDER	560
205	Compuclassics	MAIL ORDER	565
*	Demark International	MAIL ORDER	567
*	EXCEL MICRO	MAIL ORDER	566
352	FASTMICRO	MAIL ORDER	556-557
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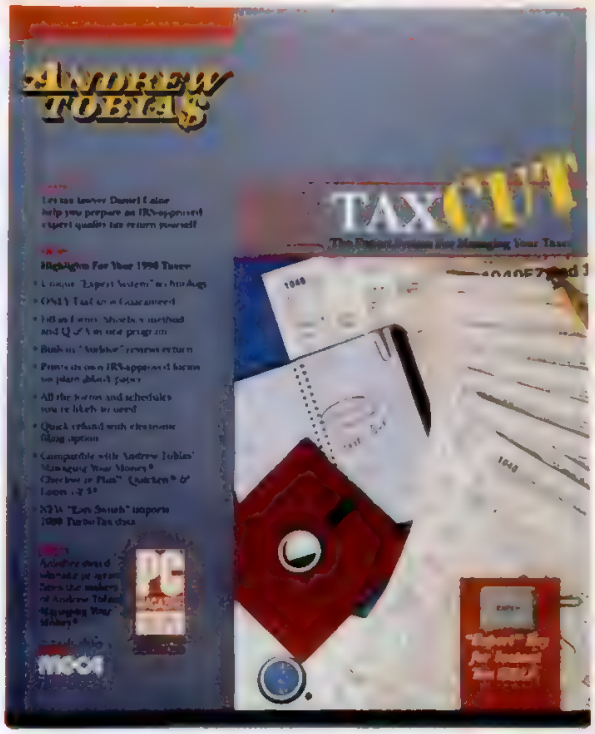

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After Hours

Products for the Leisure Side of Personal Computing

Accolade and Jack Nicklaus Team Up on Golf Simulation

GAMES
by Jeff Prosise

When was the last time you crunched a 3-wood 240 yards and watched the shot hover momentarily over the green, then drop 6 feet from the pin? Or lofted a wedge 95 yards to a pin nestled in the corner of a well-guarded green? That's exactly how it feels every time you crank up Accolade's *Jack Nicklaus' Unlimited Golf & Course Design*, the best, most realistic golf simulation on the market for IBM PCs and compatibles, bar none.

One of the first golf programs to take advantage of the VGA's 256-color 320-by-200 graphics mode, *Nicklaus* offers breathtaking scenery from tee to green that just about convinces you you're really there. If you run it on other graphics adapters, resolution and color are downgraded according to the capabilities of the adapter; even then, *Nicklaus* makes the best of what's available to bring you great graphics.

First and foremost, *Nicklaus* provides a great golf simulation. All the hazards are there: sand, wind, water, out of bounds, trees, bushes, and virtually anything else you find yourself in or under in the *real* game of golf. The greens are undulated, some of them so severely that it's difficult to get down in two unless you can get your approach within striking distance of the cup.

You can hook, slice, or hit the ball straight, depending on how good or bad your timing is. You can aim your shots anywhere, choosing to play it safe by hitting down the middle of the fairway, or live dangerously by cutting the corner of the dogleg. And even without a sound board (*Nicklaus* supports CMS, Roland, and AdLib sound boards for *really* realistic sound), the program does a pretty good job of duplicating the sounds of the game—especially the splash of a ball hitting sand or water.

The options are myriad. Want to replay that lost shot? No problem! *Nicklaus* lets you bring it back and hit it again. Or how about a reverse-angle replay of the last shot so you can relive the first eagle you ever made? You can do that, too.

Each new hole starts out with an overhead view showing everything that lies between the tee and the green. If you like, you can zoom down and view any part of the hole from any angle. You can play skins or stroke, by yourself or against live opponents, or against a computer opponent if you're the only golfer in the house. A word of warning: when you choose an electronic opponent, don't go up against Jack himself unless your game is up to par. He plays almost every shot perfectly. *Nicklaus* also keeps a record for you of the best rounds played on each of the different courses and provides game statistics as you go along.

Jack Nicklaus' Unlimited Golf features realistic scenery rendered in beautiful 256-color VGA graphics.

When it comes to courses, *Nicklaus* doesn't sell you short. The package comes with two courses—a replica of Nicklaus's famous Muirfield Village in Ohio, and a fictitious one, called The Bear's Track, designed by Jack Nicklaus himself especially for this game. When you grow tired of these, more are available on course disks sold separately, including Oak Hill, Royal Troon, Kemper Lakes, the Australian Golf Club, Saint Creek, St. Mellion, Medinah, St. Andrews, and Shoal Creek. Course disks (the same disks sold in conjunction with Accolade's *Jack Nicklaus' Greatest 18 Holes of Championship Golf*) contain three courses each and list for $21.95.

But the niftiest feature of *Jack Nicklaus' Unlimited Golf & Course Design* is the course editor, which lets you design your own courses or modify the ones you already have (courses designed for *Greatest 18 Holes* can be played in Nicklaus, but they cannot be edited). This is a comprehensive and well thought-out program; for example, the editor lets you start from scratch with an undeveloped plot of land.

CONTINUES

When putting in *Jack Nicklaus' Unlimited Golf*, you can turn on a grid that enhances your view of the green.

Nicklaus Golf

CONTINUED

Three different plots are provided with the package. You can modify them to your heart's content and play golf course architect by laying out tees, greens, and fairways.

You zoom in on individual holes to refine fairways and greens, contour hills, and add trees, rough, water, cart paths, and sand. You can even create custom backgrounds using paint tools supplied with the package so that your golfers will see scenery consistent with the type of course you've laid out. No detail is spared, making course design here as close to the real thing as the electronic medium will allow.

The manual helps by offering a thorough overview of golf course design as espoused by the Golden Bear himself, and providing sample course designs which demonstrate the principles. This part of the package provides a bona fide, if abbreviated, education in golf course design. Windows pop up to offer helpful advice as you create your courses. And should the windows start to annoy you, the press of a button prevents them from popping up in the future. That's a real touch of class.

Accolade endowed *Nicklaus* with a relatively benign form of copy protection, the by-now familiar code wheel. When you start up either the golf or the design portion of the simulation, you're asked to align the layers of the wheel in a particular way and type in the number that comes up. On the plus side, this protection scheme doesn't place any sort of barrier on your hard disk. On the other hand, it is bothersome to have to carry that darn wheel around everywhere, especially if you install Nicklaus on a laptop.

Is there a downside to *Jack Nicklaus' Unlimited Golf & Course Design?* You bet there is. It's like a new Tom Clancy novel: You simply can't put it down. Plan to drop everything you're doing when you break the game out of the shrink wrap. After a few sleepless nights, I had to promise my wife I'd use it only in moderation—a promise that I'll keep only until Accolade brings us an add-on course disk with Augusta National or Pebble Beach.

List Price: *Jack Nicklaus' Unlimited Golf & Course Design,* Version 1.1, $59.95. **Requires:** 512K RAM, DOS 2.1 or later, graphics adapter. Mouse optional. Accolade, 550 S. Winchester Blvd., #200, San Jose, CA 95128-2545; (408) 985-1700.

CIRCLE 409 ON READER SERVICE CARD

Jigsaw Software Puts the Pieces Together On-screen

GAMES by Jeff Proise

John Spilsbury, a British printer, is credited with making the first jigsaw puzzle in the early 1760s. He glued a map to a wooden board and sawed along country boundaries. The results were originally called dissections, but the name changed in the early 20th century to that of the tool used to produce them. Most of today's puzzles are printed on cardboard and die cut, but there are also jigsaw puzzles designed just for the PC.

Jigsaw: The Ultimate Electronic Puzzle, from Britannica Software, comes with 11 picture puzzles to solve, including a suspension bridge, a river boat gambler, and a valentine. If you want even more pictures, *Jigsaw* can "cut" any picture created with *PC Paintbrush* (.PCX files) into a puzzle. Setup is from a *Windows*-type menu where you select the puzzle of your choice along with options to control the number of puzzle pieces and the accompanying sound.

Once you've seen the completed picture (high resolution for VGA or medium resolution for EGA), clicking the mouse causes the picture to scramble into 8, 15, 40, or 60 pieces. Instead of the interlocking shapes with little tabs found in conventional jigsaw puzzles, these pieces take the form of equally sized rectangles.

Since all of the puzzle pieces appear on the screen, restoring the picture is a matter of putting pieces in the correct order; this is done by clicking on one piece and then another to swap their locations. A melodious tone verifies that a piece is in the correct position.

While this isn't a true jigsaw-style puzzle, it is a real challenge when a picture is cut into 60—or even 40—pieces. By varying the number of pieces, you can select a difficulty level for any member of the family, although the menu system is beyond the grasp of small children. Nicholas, my three-year-old-neighbor, loves to solve eight-piece puzzles, but as a nonreader he can't manage the close file, open file, scramble picture setup routine by himself.

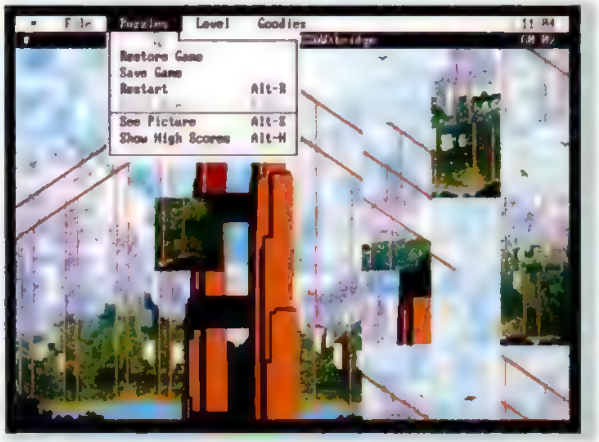
A clock keeps track of how long it takes to complete each puzzle, and a file-save option lets you come back if you can't solve it in one sitting. The ultimate challenge is with the "hard-way" option enabled—this is like finding the pieces of an unknown puzzle in a Mason jar.

Living Jigsaw, from Miles Computing, is a true jigsaw puzzle simulation—but with something extra. The program comes with 15 pictures, including a tiger, clocks, birds, a car, and a seascape to name a few, and each picture is animated—or living. The clocks picture, for example, shows many clock faces with moving hands and a moon-faced clock that seems to wink.

Any of the puzzles can be solved in super easy, easy, medium, or hard mode. At each level of difficulty you pick from eight differently shaped pieces, each of which "cuts" the puzzle into a different number of parts. For example, clocks at the super easy level can be "cut" into six square pieces, eight triangular pieces, nine mushroom-shaped pieces, 12 irregularly shaped pieces, or any of four other shapes. Clocks at the hard level can be cut into as few as 107 or as many as 249 pieces. All these variations give you the equivalent of 480 different puzzles.

If you think putting a conventional jigsaw together is difficult, wait until you try one that's animated. Actually, the movement can be helpful. Unlike *Jigsaw*, all of whose puzzle pieces are oriented correctly, *Living Jigsaw's* pieces can be turned in any of four directions, so when you see the hands on a clock face rotating counterclockwise, you get a clue as to the pieces' correct orientation.

Perhaps the most difficult part of *LJ* is learning to use the complex and sometimes awkward user interface. There are two types of screens: One on which



***Jigsaw* uses *Windows*-like pull-down menus to select pictures and set options.**

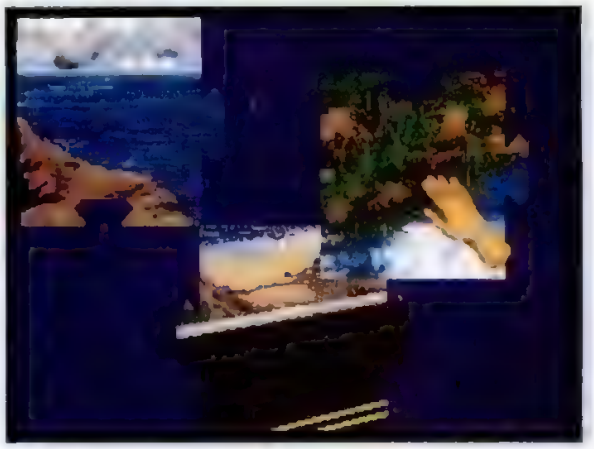
Jigsaw Puzzles

CONTINUED

to build the puzzle and another which contains the pieces. To make the pieces distinct and legible, they are scattered on as many as eight different screens. Switching back and forth among screens and picking up pieces takes a little patience. I found the best way to play is to pick up all the pieces on one of those screens and then move to the puzzle screen, put the pieces down and try to fit some of them together. If you get stumped, you can click on an elf's-cottage icon and he will pop out, pick up a piece, and place it in the correct position on the puzzle screen. Although the animation in *Living Jigsaw* is superb, this one's not for small children, either.

There's an abundance of control keys, including settings to change the background color, place all border pieces in their correct positions, stop the animation, properly orient all pieces, and even one to turn all pieces a solid color. The manual suggests that if you get bored you could turn the background white and the pieces white and solve the polar-bear-in-a-blizzard puzzle. Believe it or not, I don't think they were kidding.

The graphics and animation in *Living Jigsaw* make it the Ferrari of jigsaws and well worth owning, but it was just too difficult for me to solve any of the puzzles with more than about 40 pieces. *Jigsaw*, on the other hand, is easier to work with (since everything is done on the same screen), but somehow I felt a little bit cheated that the pieces weren't jigsaw-puzzle shaped and weren't disoriented. Still, whichever program you choose, you won't have to worry about losing pieces or finding an empty table to use. That gives either of these programs a distinct advantage over conventional jigsaws.



At its easiest level, *Living Jigsaw* cuts the picture into six pieces, but they may be not be properly oriented.

List Price: *Jigsaw: The Ultimate Electronic Puzzle*, $39.95. **Requires**: EGA or VGA graphics, DOS 3.3 or later, 512K RAM. Mouse recommended. Britannica Software, P.O. Box 77186, San Francisco, CA 94107; (800) 572-2272.

CIRCLE 410 ON READER SERVICE CARD

List Price: *Living Jigsaw*, $39.95. **Requires**: 256K RAM for CGA, 384K for EGA, or 512K for VGA graphics. Mouse recommended. Miles Computing, 5115 Douglas Fir Rd., Calabasas, CA 91302; (818) 340-6300.

CIRCLE 411 ON READER SERVICE CARD

Accolade's Ishido Sets a Mood As It Teases Your Brain

by Carol Levin

Poetic license can add immeasurably to the appeal of computer games, which are, for the most part, rooted in fantasy. *Ishido, The Way of Stones*, from Accolade, mixes ancient mysticism with conjecture and state-of-the-art production values to produce an absorbing, challenging diversion. Accolade constructs an elaborate legend as a context for *Ishido*. The "Rule of Four," which is central to the game, is posited as a cornerstone of Taoism, the Chinese mystical philosophy founded by Lao-Tzu in the 6th century B.C.

The game documentation tells us that the ancient philosopher realized that much of the observable world breaks down into groups of four. There are the points of the compass (north, south, east, and west), the basic elements (earth, air, fire, and water), and the four seasons, to name just three examples. *Ishido* applies this concept in mesmerizing fashion as it puts you through hours of cerebral gymnastics on your way to solving a puzzle of colors, shapes, and symbols.

This deceptively simple game combines the complexity of the Rubik's Cube with the mysteries of the Ouija board. But to understand the compelling appeal of *Ishido*, you must go beyond the simple rules of play to the rich and ancient history of the enigmatic Way of Stones. The legend of *Ishido* dates back thousands of years, and spans several continents and civilizations.

An archaeological dig among Druidic ruins in northern England unearthed fragments of an *Ishido* playing board along with some stone game pieces. The find was carbon-dated to the pre-Bronze Age. Shortly after this discovery in the early '60s (1960s, that is) similar artifacts were found in the sarcophagus of an Egyptian pharaoh, in a Hopi pueblo in New Mexico, in the Israeli desert, in the Nepalese highlands, in a Mayan pyramid, and in a Taoist monastery. . . or so the legend goes.

Even if you have no use for legend and conjecture, you will get just as much enjoyment out of this challenging game. In its most modern incarnation, *Ishido* is rendered in beautiful VGA graphics and supports digital sound. As you play, you attempt to accurately match a set of 72 stones according to their colors and patterns on a board of 96 squares.

The opening screen displays the gameboard, with six stones representing each symbol and color in the "stoneset." There are six symbols and six colors in each stoneset, which makes for a total of 36 unique pairs of stones. The screen also displays a pouch that indicates the number of remaining stones, a scoreboard, a "touchstone" where the next stone to play is displayed, and a pull-down option menu.

At each turn, the computer draws one stone from the pouch and displays it on the touchstone. Your objective is to place each stone on the board so that its color or symbol matches that of the stone next to it. As the board fills with stones, it is increasingly difficult to place stones advantageously. You are awarded points for each legal match, and the game is over when there are no more matches or when the pouch is empty.

To create a one-way match you must match your stone—randomly selected from the pouch by the computer—with a stone on the board according to one of your stone's two attributes—color or symbol. You're awarded more points for matching two sides of the stone and even more for matching three sides. The ultimate goal is to create a four-way match by placing a stone in the center of four other stones, matching two of the stones on one attribute and the other two stones on the other attribute.

If playing *Ishido* is relatively simple, mastering the game is a more demanding and subtle pursuit. Emptying the pouch while simultaneously creating as many four-ways as possible requires the skill and experience of an *Ishido* master.

To guide you on the path to mastering *Ishido*, you can call upon the optional "cheating"

CONTINUES

Ishido

CONTINUED

functions: ask the computer to show you all the possible moves on the board at each turn; click on the pouch to see exactly which stones have not yet been played; or take your last turn over. Each is equivalent, however, to peeking at your opponent's bridge hand or Scrabble tiles.

You can play by yourself, against one or more opponents, with one or more partners, or with or against the computer. You can also watch the computer play by itself to help sharpen your own strategy. To stimulate intense competition, you can set a 5- to 60-second time limit for each move. A time limit of 2 to 60 minutes can be set for an entire game. If you prefer to meditate over each move you can do so and save games in progress.

For more visual variety, you can play on a simulated wooden, marble, or ebony playing board. You can also select stonesets modeled after symbols of gems, alchemy, Stonehenge, Native America, China, or Japan. With the included graphics editor or *Deluxe Paint*, you can design your own stoneset. Sixteen patterns are available for CGA and Hercules graphics modes, and 16 colors for EGA, VGA, MCGA, and Tandy.

Creating a four-way match is the most difficult challenge in Accolade's deceptively simple *Ishido*.

Aside from the challenge and enjoyment it offers as a conventional game, *Ishido* can be used (if you believe in such things) as an oracle. After successfully creating a four-way match in the course of a game, you select "oracle" from the options menu. You are prompted for a question, and then the game displays an augury in response to your query. Oracle readings are based on the ancient Chinese philosophy of the I Ching, which provides guidance for solving life's puzzles. It uses synchronistic context and mathematical probabilities to produce a usually cryptic reading.

Ishido has the makings of a computer game classic. It is simple enough to be almost immediately accessible and enjoyable, yet complex enough to provide hours and hours of challenging play. Add the beautiful graphics and the mystique that Accolade so effectively creates, and you've got one excellent example of what gaming software can truly be.

List Price: *Ishido*, $54.95.
Requires: 512K RAM (Tandy 16-color graphics and VGA require 640K), DOS 3.0 or later, graphics adapter. Accolade, 550 S. Winchester Blvd., #200, San Jose, CA 95128; (408) 985-1700.

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- ✔ mailing labels
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- ✔ daily closeout reports
- ✔ accepts split tender
- ✔ view in-stock status
- ✔ pull down menus
- ✔ pop-up windows
- ✔ source code available
- ✔ 99 levels of password protection
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- ✔ prints bar code labels
- ✔ reorder reports
- ✔ extensive sales reports
- ✔ item/invoice discounts
- ✔ tracks sales by employee
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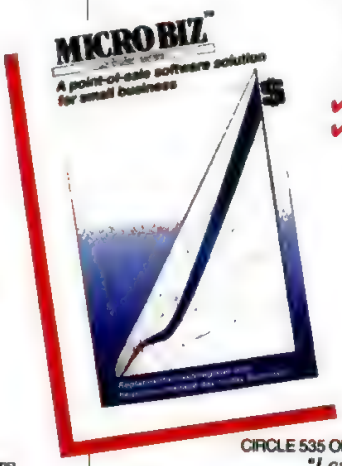

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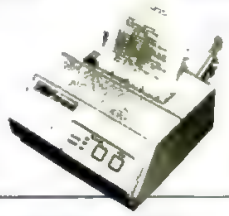

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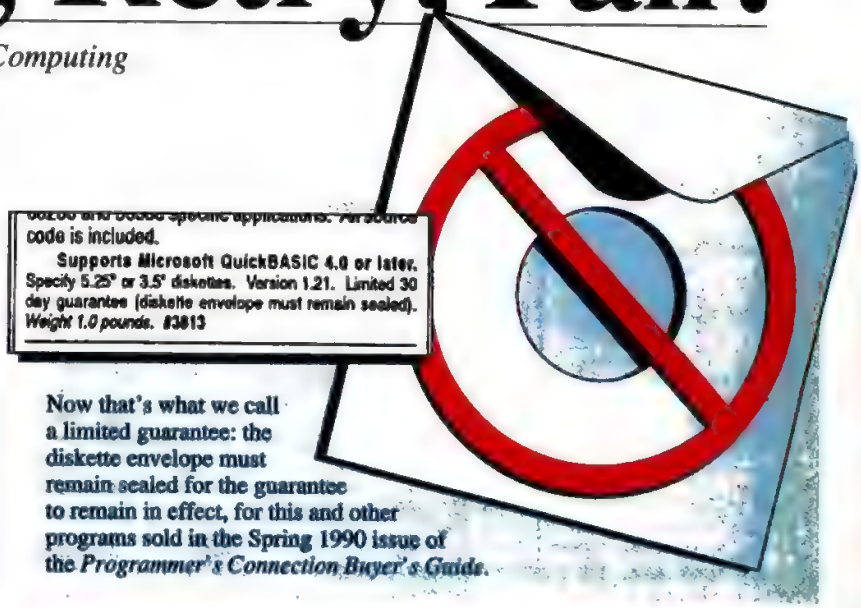

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Southwest Computer and Business Equipment Review, April 1990

A Germ of an Idea Peeks Through the Prose

Explanation for entering commands in the *XTreePro Gold* Command Shell, as described by the *XTreePro Gold* Operations Manual:

"When you are typing and editing an input line in the Command Shell, the same keys that are available for editing in the input line are available for editing."

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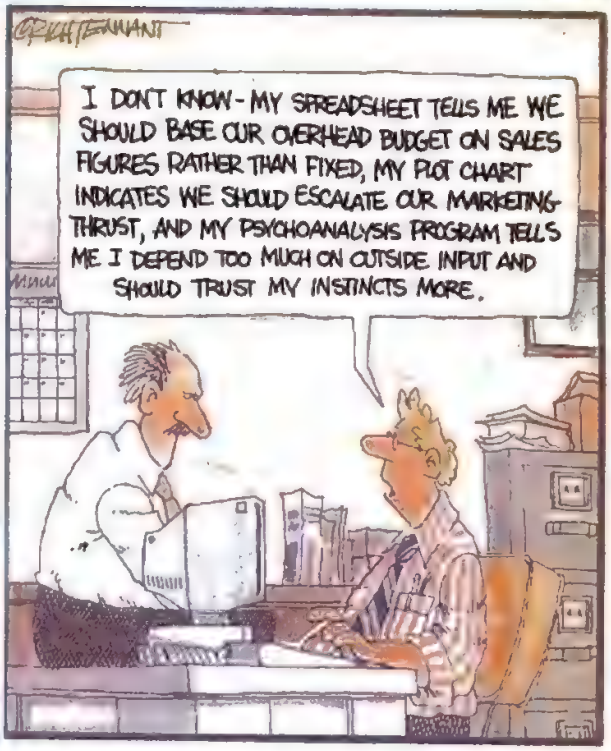

CARTOON: RICHARD TENNANT

If your entry is used in Abort, Retry, Fail? we'll send you $50 and a *PC Magazine* T-shirt. Caution: In case of multiple entries, the postmark date, neatness and completeness of entry are considered. Winners this issue: Paul Maxson (4MB cache memory), Joshua Walfish (limited 30 day guarantee), George W. Taylor (XTreePro editing), M.H. Patrovsky (more efficient problems).

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